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Air Quality Data for Nonmetallic Inorganic Ions Nitrate and Sulfate for 1979 from the National Air Surveillance Networks

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AIR QUALITY DATA FOR NONMETALLIC INORGANIC IONS: NITRATE AND SULFATE FOR 1979 FROM THE NATIONAL AIR SURVEILLANCE NETWORKS

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Comparison of the 1979 data with that from previous years in the decade shows that NASN nitrate concentrations summarized on a nationwide basis increased substantially during the 1970's. In areas classified as urban, the average rate of increase was 6.2% per year while nitrate ion in nonurban areas increased at an average rate of 9.6% per year during the nine-year period. Average NASN sulfate concentrations do not exhibit a constant trend through the 1970's, but have apparently increased in both urban and nonurban areas since 1976. Some of the variability from year to year may be due to different sets of sites being used in the summarizations.

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FOREWORD

Measurement and monitoring research efforts are designed to anticipate potential environmental problems, to support regulatory actions by developing an in-depth understanding of the nature and processes that impact health and the ecology, to provide innovative means of monitoring compliance with regulations and to evaluate the effectiveness of health and environmental protection efforts through the monitoring of long-term trends. The Environmental Monitoring Systems Laboratory, Research Triangle Park, North Carolina, has the responsibility for assessment of environmental monitoring technology and systems; implementation of agency-wide quality assurance programs for air pollution measurement systems; and supplying technical support to other groups in the Agency including the Office of Air, Noise and Radiation, the Office of Toxic Substances and the Office of Enforcement.

Concentrations of sulfate and nitrate ions in particulate matter from the National Air Surveillance Networks are presented in this report. Measures of the analytical data quality (precision and accuracy) are also included. This report is essentially a continuation in a series of publications of network data.

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ABSTRACT

The National Air Surveillance Networks, which have existed for over twenty years, provide information on air quality for many urban and non-urban locations within the United States. This report summarizes the network data for two nonmetallic inorganic ions (nitrate and sulfate) determined from high volume samples collected during 1979. Concentration values are presented in the form of cumulative frequency distributions. Arithmetic and geometric sample statistics are also reported as are measures of the precision and bias associated with the analytical methods employed. Earlier publications[1-4] have reported data collected during 1971 through 1978.

Comparison of the 1979 data with that from previous years in the decade shows that NASN nitrate concentrations summarized on a nationwide basis increased substantially during the 1970's. In areas classified as urban, the average rate of increase was 6.2% per year while nitrate ion in nonurban areas increased at an average rate of 9.6% per year during the nine-year period. Average NASN sulfate concentrations do not exhibit a constant trend through the 1970's, but have apparently increased in both urban and nonurban areas since 1976. Some of the variability from year to year may be due to different sets of sites being used in the summarizations.

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The data in this publication were collected with the generous support of the many state and local air pollution control agencies that operate the National Air Surveillance Network stations. Also, the ten EPA Regional Offices have participated in this program since 1973 by sending weighed high volume filters to the centralized laboratory of the Environmental Monitoring Systems Laboratory for analysis.

The authors also thank those who contributed their time and effort to publishing this document.

SECTION 1

INTRODUCTION

ORGANIZATIONAL STRUCTURE

The U.S. Environmental Protections Agency conducts a variety of air sampling activities to obtain information about air quality in the United States. Often this work is accomplished with the assistance and cooperation of state and local agencies. One such program consists of the National Air Surveillance Networks (NASN) which have existed for over 20 years. As shown in Table 1-1, several changes in the operation of the NASN have occurred since January 1972.

TABLE 1-1. NASN NETWORK MODIFICATIONS

Month/Year	Change	Impact*
January 1972	Sample schedule changed from random biweekly to 12-day systematic samples, first sample collected 1/10/72.	All sites
December 1972	Decentralization, Region II	NJ, NY, PR
April 1973	Decentralization, Region I	CT, ME, MA, NH, RI, VT
December 1973	Decentralization, Regions V, VII, VIII, IX, X	IL, IN, MI, MN, OH, WI, IA, KS, MO, NE, CO, MT, ND, SD, UT, WY, AZ, CA, HI, NV, AK, ID, OR, WA
January 1974	Decentralization, Regions III, IV, VI	DE, DC, MD, PA, VA, WV, AL, FL, GA, KY, MS, NC, SC, TN, AR, LA, NM, OK, TX

*Abbreviations coincide with standard U.S. mail code designations for states.

The first change, in sampling schedule, was made to encourage coincident sampling with state and local ambient monitoring programs. In addition to assisting with the EPA sampling network, state and local agencies administer their own air pollution control programs. These changes were made to promote better overall program coordination.

The second change, decentralization, was undertaken to shift air monitoring responsibilities from one centralized laboratory - the Environmental Monitoring Systems Laboratory at Research Triangle Park (EMSL/RTP) - to the 10 EPA regional laboratories. The 14-month decentralization process was completed in January 1974.

Also in January 1974, the responsibilities of the 10 EPA regional offices were expanded to include overall management of the NASN sites. Additional duties included weighing sample filters and determining concentrations of total suspended particulates (TSP). Table 1-2 and Figure 1-1 show the regional office locations and the geographic areas they serve.

TABLE 1-2. EPA REGIONS AND LOCATIONS OF REGIONAL OFFICES

Region	Regional Office Location
I	Boston, Massachusetts
II	New York, New York
III	Philadelphia, Pennsylvania
IV	Atlanta, Georgia
V	Chicago, Illinois
VI	Dallas, Texas
VII	Kansas City, Missouri
VIII	Denver, Colorado
IX	San Francisco, California
X	Seattle, Washington

Currently, after completing their tasks, the regional laboratories send sample filters to the EPA Filter Bank (FB) for routine analysis of trace constituents, such as metals, nonmetallic inorganic ions, and benzo(a)pyrene (BaP). Filters are stored at the FB for nonroutine, special analyses as needed.

Although pollutant monitoring is decentralized, analysis and publication of trace pollutant data remains the responsibility of EMSL/RTP.

SAMPLE COLLECTION

Air quality samples are collected at several urban and nonurban NASN sites located across the country. Urban sites are generally located within a city, town, or adjacent suburb. Nonurban sites were originally located in rural or remote areas, although over time, many of these rural areas became more heavily populated and were subjected to the influences of

Figure 1-1. EPA Regions and Regional Offices

spreading urbanization. Voluntary operation of each site was provided through the generous assistance of local or state agencies, and individuals such as park rangers, firemen, and policemen.

Prior to 1972, 24-hour samples (beginning at midnight) were collected according to a biweekly (26 samples per year) modified random sampling schedule. The schedule was modified to ensure equal representation for each day of the week.

Since January 10, 1972, samples have been collected every twelth day (30 or 31 samples per year). This schedule is easily implemented in the field, and no longer needs annual revision.

DATA HANDLING AND ANALYSIS

After performing their duties, the regional laboratories send TSP values to the National Aerometric Data Bank (NADB). Weighed filters are sent to the FB for routine, trace constituent analysis, and for storage until nonroutine analyses are needed. Resulting data are published by EMSL/RTP and sent to the NADB for archiving.

Sampling data for air quality summaries were screened by EMSL/RTP to exclude anomalous data. Precision and bias of the analytical data were determined using statistical analysis. Data accuracy was determined to assist with interpretation of air quality summaries.

The air quality summaries presented here include annual concentration data classified by urban and nonurban origin, and were compiled for the nation as a whole, as well as for individual site locations. Data are presented as cumulative frequency distributions. Arithmetic and geometric means, and standard deviations, are also tabulated.

SECTION 2

LABORATORY METHODS

SAMPLING PROCEDURE

The mass of particulate matter per volume of air was determined by weighing a filter before and after sampling, and measuring the sample air flow rate. Air was drawn through a preweighed glass fiber filter with a high volume air sampler.

The sample air flow rate was set at approximately 1.7 cubic meters per minute, or approximately 2500 cubic meters of air during the 24-hour sampling period. A calibrated flow meter was read at the beginning and end of the sampling period, and the average value was used to obtain the average sample flow rate. Using the sampling time (24 hours) and the measured flow rate, the total sample volume of air was determined.

The filters, 20.3 by 25.4 cm, were made of flash-fired glass fiber selected for low and uniform background concentrations of the pollutants to be measured. To eliminate filters having pinholes, creases, or other flaws that could affect air flow, the filters were visually screened for imperfections by placing each filter in front of a beam of light. Prior to the initial weighing, the filters were equilibrated for a minimum of 24 hours at a temperature of 24° Celsius and a relative humidity of 50 percent or less. A balance scale was used that permitted weighing the filters without bending them.

The filters were then distributed unfolded to the cooperating local agencies for the urban sites and to the designated participant responsible for operating the nonurban site. After sampling, the filters were folded in half lengthwise with the collected particulate matter inside, and returned to the laboratory. The filter with the collected particulates was again equilibrated for at least 24 hours at a temperature of 24° Centigrade and a relative humidity of 50 percent or less, and then weighed to determine the amount of particulate matter that was collected. These suspended particulate mass values were sent to the NADB on a routine basis and the filters were sent to the FB for further analyses.

NONMETALLIC ION ANALYSIS PROCEDURE

Analysis for inorganic ions during 1979 was performed by Northrop Services, Incorporated - Environmental Sciences, under Contract No. 68-02-2566. Tasks included analysis of blank filters, duplicate strips, and the routine sample filters.

Analyses for nitrate and sulfate ions were performed with autoanalyzers on an aqueous extract of an 8.3 percent section of the particulate filter; i.e., a 1.9 cm strip was cut across the fold. The filter section was washed twice to obtain the final volume of 50 milliliters. This single solution was used for both analyses.

The analytical procedure for each ion was as follows:

1. The aqueous extract was analyzed for nitrate ion by reduction of the nitrate to nitrite by a copper-cadmium reduction column. The nitrite was reacted with sulfanilamide in acidic solution to form a diazo compound. This compound then coupled with N-1-Naphthylenediamine dihydrochloride to form a reddish-purple azo dye which was determined colorimetrically at a wave length of 520-540 nanometers.

2. The extract was analyzed for sulfate ion by the methylthymol blue (MTB) method using a single channel Technicon Autoanalyzer II system equipped with a linearizer. The MTB method is based on the spectral difference which exists in basic solution (pH 12.5-13.0), between the barium complex of MTB and free MTB. At this pH, the barium complex is blue and free MTB is brownish-red (absorbs light at 460 nm). Thus, the color of solutions containing both the free MTB and the complex appears as gray. The amount of free MTB, monitored colorimetrically at wave lengths of 460-480 nanometers, was the measure of the amount of sulfate in the sample.

SECTION 3

QUALITY CONTROL

INTRODUCTION

This section presents the quality control data from which analytical performance was determined. Assessment of analytical performance includes estimation of precision and bias. These estimates are statistically combined to determine an overall measure of analytical quality. It is important to note that there are several potential sources of measurement error (e.g., flow control, artifact formation, shipping and storage losses) associated with sample collection and handling procedures which are not under direct control by EMSL/RTP. These sources are not included in the estimates of data quality presented here.

PRECISION

Table 3-1 presents precision estimates for the various analyses. Measures of precision are expressed as percentages of concentration level because precision is generally concentration dependent.

Precision estimates are based upon percent differences, determined from analyses performed on two filter strips taken from the same filter. Thus, the measure of precision includes variation caused by cutting, extracting, and analytical processing, as well as any actual variability between filter strips. Precision measurements were made throughout the analysis period. Duplicate strips of every twentieth sample were analyzed, and precision estimates obtained. For each pair of data, percent differences were computed using the following formula:

$$\%d = [2(x_1-x_2)/(x_1+x_2)](100) \qquad (1)$$

where $\%d$ = percent difference between analyses of duplicate strips (difference between values divided by the average of the two values), percent

x_1, x_2 = concentration values of the two analyses of duplicate strips, $\mu g/m^3$

For each pollutant concentration range, as shown in Table 3-1, the average percent difference ($\overline{\%d}$) and the standard deviation of percent differences ($S_{\%d}$) were calculated. The standard deviation of percentages is calculated by the following equation:

$$S_{\%d} = \left[\frac{\Sigma \%d^2 - (\Sigma \%d)^2/n}{n-1}\right]^{0.5} \quad (2)$$

The standard deviation shown in Equation 2 applies to percent differences determined from results from duplicate strip analyses, and provides a basis for control limits that may be applied to results of future duplicate strip analyses. The standard deviations and the 99 percent control limits associated with the percent differences between duplicate strips are shown in Table 3-1.

The standard deviations in Table 3-1 must be divided by $\sqrt{2}$ to obtain the standard deviation (actual coefficient of variation) that measures the analytical precision of a single reported pollutant concentration value. It has been shown that, for normal underlying parent distributions with coefficients of variation, τ, less than 0.35, the distribution of 5 percent differences is approximately normal with standard deviation, $\sqrt{2}\tau$.

The coefficient of variation values are also reported in Table 3-1 and can be used for computing approximate confidence limits on individually reported pollutant concentration values, considering precision only (i.e., assuming no bias). Approximate confidence limits are computed from the following formula:

$$L_u = X\,[1 + kC_v/100] \quad (3a)$$

$$L_\ell = X\,[1 - kC_v/100] \quad (3b)$$

where L_u = upper confidence limit, $\mu g/m^3$

L_ℓ = lower confidence limit, $\mu g/m^3$

X = single reported sample value, $\mu g/m^3$

k = standard normal deviate corresponding to the desired confidence level

C_v = coefficient of variation of individual analysis values, percent

As a sample calculation, assume that an individually reported concentration for NO_3^- in 1979 is 5.3 $\mu g/m^3$. In Table 3-1, the corresponding value for the coefficient of variation is 3 percent. Assuming that 95 percent confidence limits of the true value are desired, the value of k is 1.96. Substituting these data in Equation 3:

$$L_u = 5.3\,[1 + 1.96(3)/100] = 5.6\ \mu g/m^3 \quad (4a)$$

$$L_\ell = 5.3\,[1 - 1.96(3)/100] = 5.0\ \mu g/m^3 \quad (4b)$$

TABLE 3-1. MEASURES OF PRECISION FOR 1979 NASN FILTERS

Concentration Level ($\mu g/m^3$)	Differences Between Duplicates: Std. Dev. of Percent Dif.(%)	Differences Between Duplicates: 99% Control Limits (%)	Individual Analysis Values: Coefficient of Varia.(%)	Individual Analysis Values: Approximate 95% Conf. Limits(%)
		NITRATE		
<3	10.35	± 27	7	± 14
3-6	4.29	± 11	3	± 6
>6	5.26	± 14	4	± 8
		SULFATE		
<6	8.38	± 22	6	± 12
6-20	5.90	± 15	4	± 8
>20	1.19	± 3	1	± 2

These limits can also be interpreted that if it were possible to analyze a large number of individual strips from the same filter having a true NO_3^- concentration of 5.3 $\mu g/m^3$, 95 percent of such results would fall within the stated limits.

BIAS

An independent estimate of recovery bias introduced by the analytical process for NO_3^- and $SO_4^=$ analysis is obtained through an audit program involving analysis of strips of blank high volume filters, identical to those used for ambient air sampling, but which have been spiked with known amounts of NO_3^- and $SO_4^=$. The percent recovery is calculated as follows:

$$\text{Percent Recovery} = [\text{Analyzed Value/Known Value}] \times 100 \qquad (5)$$

Bias is equal to the percent recovery minus 100.

Samples used for audits have been developed by the Quality Assurance Division (QAD) of EMSL/RTP as part of its program for assisting analytical laboratories to improve their inhouse analysis capabilities. Each lot of samples is analyzed by QAD and a corroborative laboratory before it is accepted for use in the audit program. The QAD analysis, the corroborative analysis, and the attempted spike must agree to within 5 percent of each other; and the coefficient of variation for a spike level must be less than 2.5 percent or the samples are rejected. Table 3-2 presents the bias information.

The main use of the audit results is to chronologically document the precision and accuracy achieved by the analytical laboratory. QAD has found that a meaningful way to display precision and accuracy is through mean and range control charts.

Every two weeks a set of 10 audit samples is given to the analytical laboratory to be analyzed with the ambient air samples. One blank, and triplicates in a high, middle, and low range are included in each set. The analytical laboratory distributes the audit samples as evenly as possible among the analysis days during the audit period and intersperses the audit samples throughout their normal analyses of ambient air samples. Mean and range control charts are constructed and routinely used for the high, middle, and low level samples.

Control charts for the 1979 filter analyses are presented in Figures 3-1 through 3-6. Figures 3-1, 3-2, and 3-3 show the result of $SO_4^=$ audit samples for the low, middle, and high levels, respectively. Figures 3-4, 3-5, and 3-6 show NO_3^- audit sample results for the low, middle, and high levels. The three levels correspond to the concentration levels shown in Table 3-2.

TABLE 3-2. SUMMARY OF AUDIT SAMPLE PROGRAM FOR NO_3^- AND $SO_4^=$

Mean Concentration	Recovery (%)	Bias (%)	Standard Deviation of Recovery Bias(%)	Number of Samples
		NITRATE		
<3 $\mu g/m^3$	104.1	+4.1	9.8	63
3-6 $\mu g/m^3$	97.5	-2.5	4.4	63
>6 $\mu g/m^3$	100.4	+0.4	4.2	63
All samples	100.6	+0.6	7.2	189
		SULFATE		
<6 $\mu g/m^3$	93.3	-6.7	14.9	63
6-20 $\mu g/m^3$	98.0	-2.0	3.3	63
>20 $\mu g/m^3$	97.1	-2.9	5.6	63
All Samples	96.1	-3.9	9.6	189

The means and the upper and lower control limits (UCL and LCL) were based on results from similar audit samples for 1978 filters. Control limits were three standard deviation limits representing the 99.7 percent probability limits. On the figures, the alphabetical designators along the abscissa scale (week) represent the set of audit samples given to the laboratory biweekly. Thus, the plotted values for the "Percent Accuracy" on the bottom figure of each page represent the average of the three audit samples at each level. Plotted values for "Percent Range" on the top figure of each page represent the percentage range of the three audit samples at each level, computed as follows:

$$\text{Percent Range} = [(X_H - S_L)/\bar{X}_3](100) \quad (6)$$

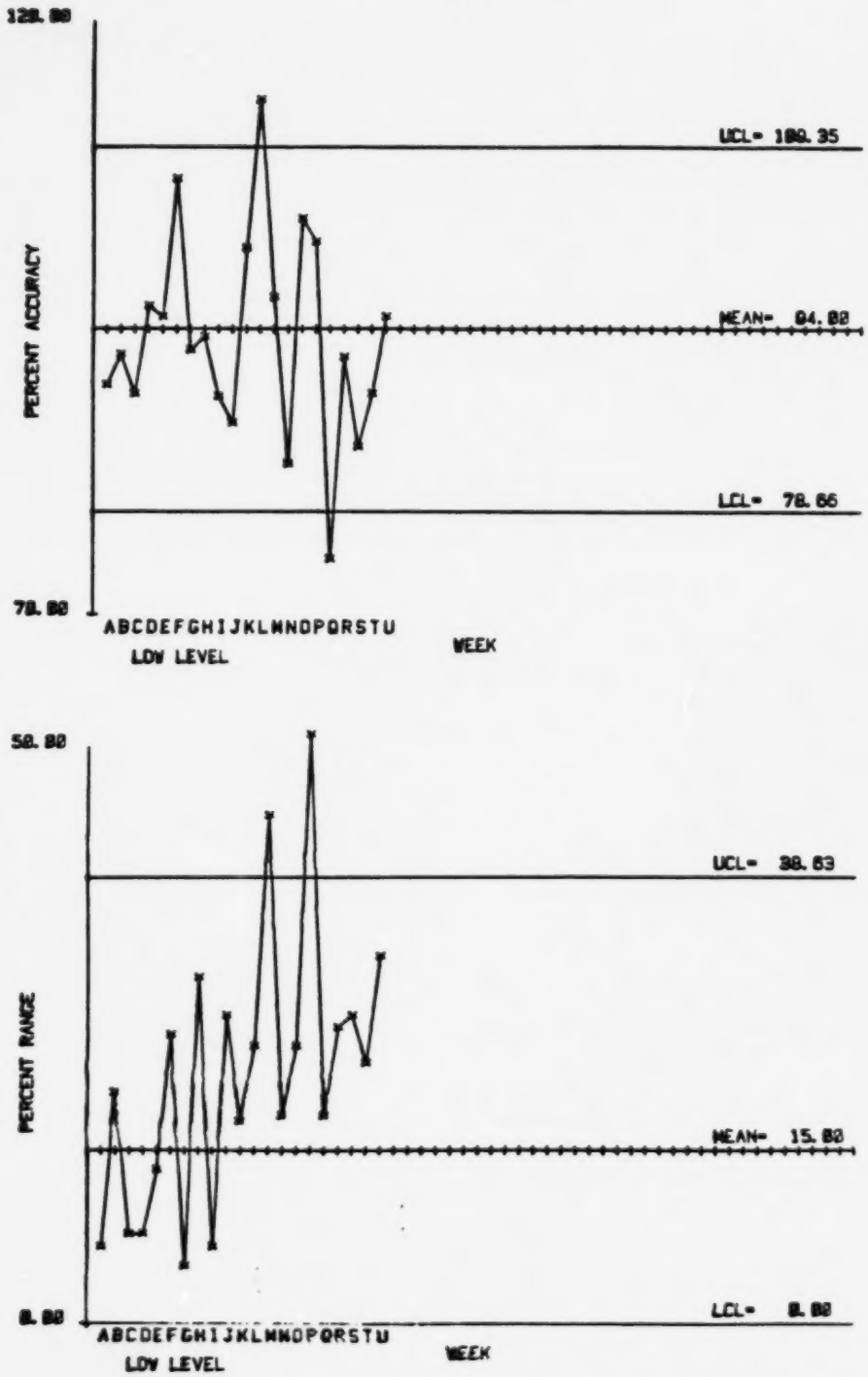


Figure 3-1. 1979 mean and range control chart (low level $SO_4^{=}$).

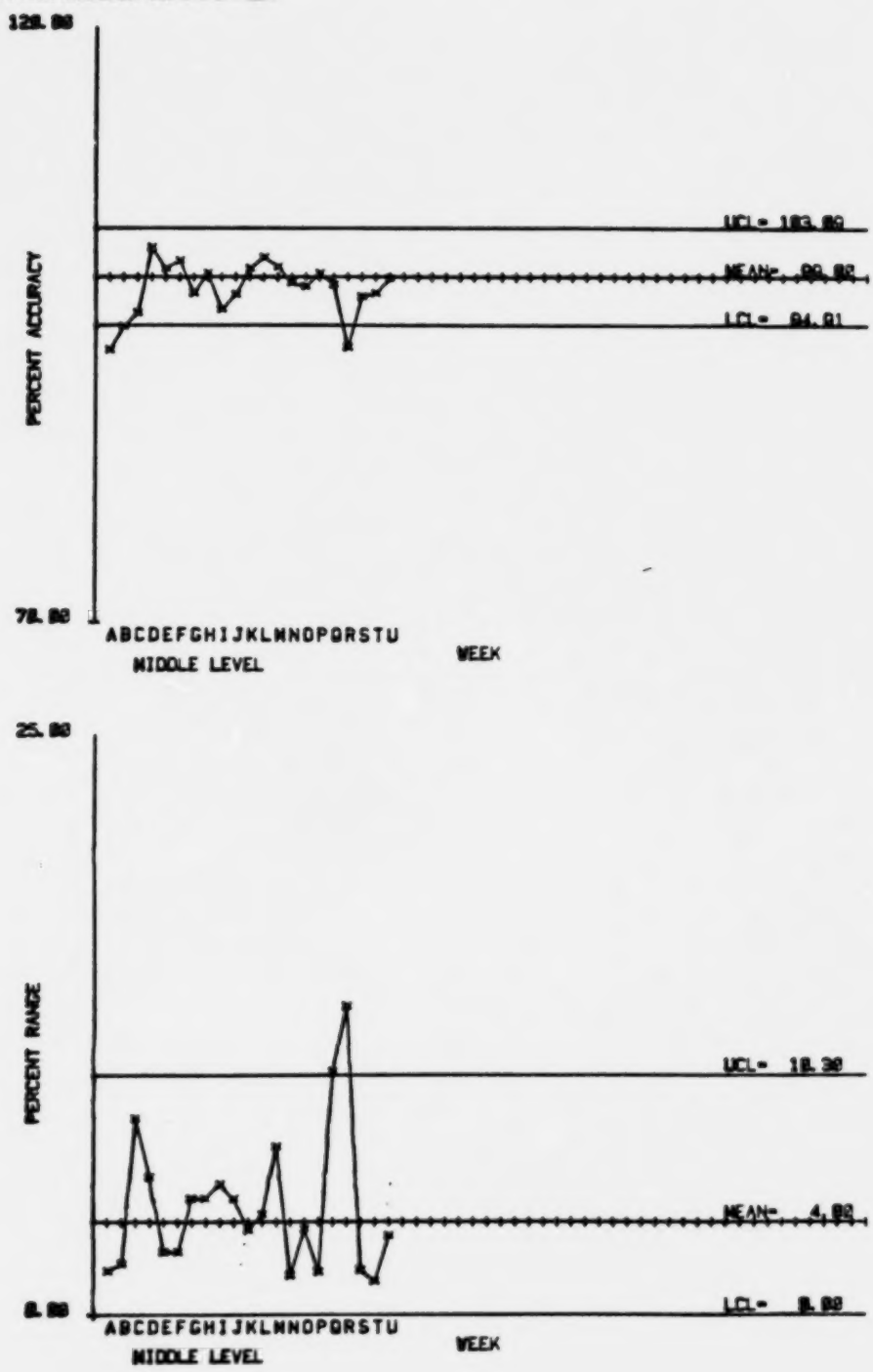


Figure 3-2. 1979 mean and range control charts (middle level $SO_4^=$).

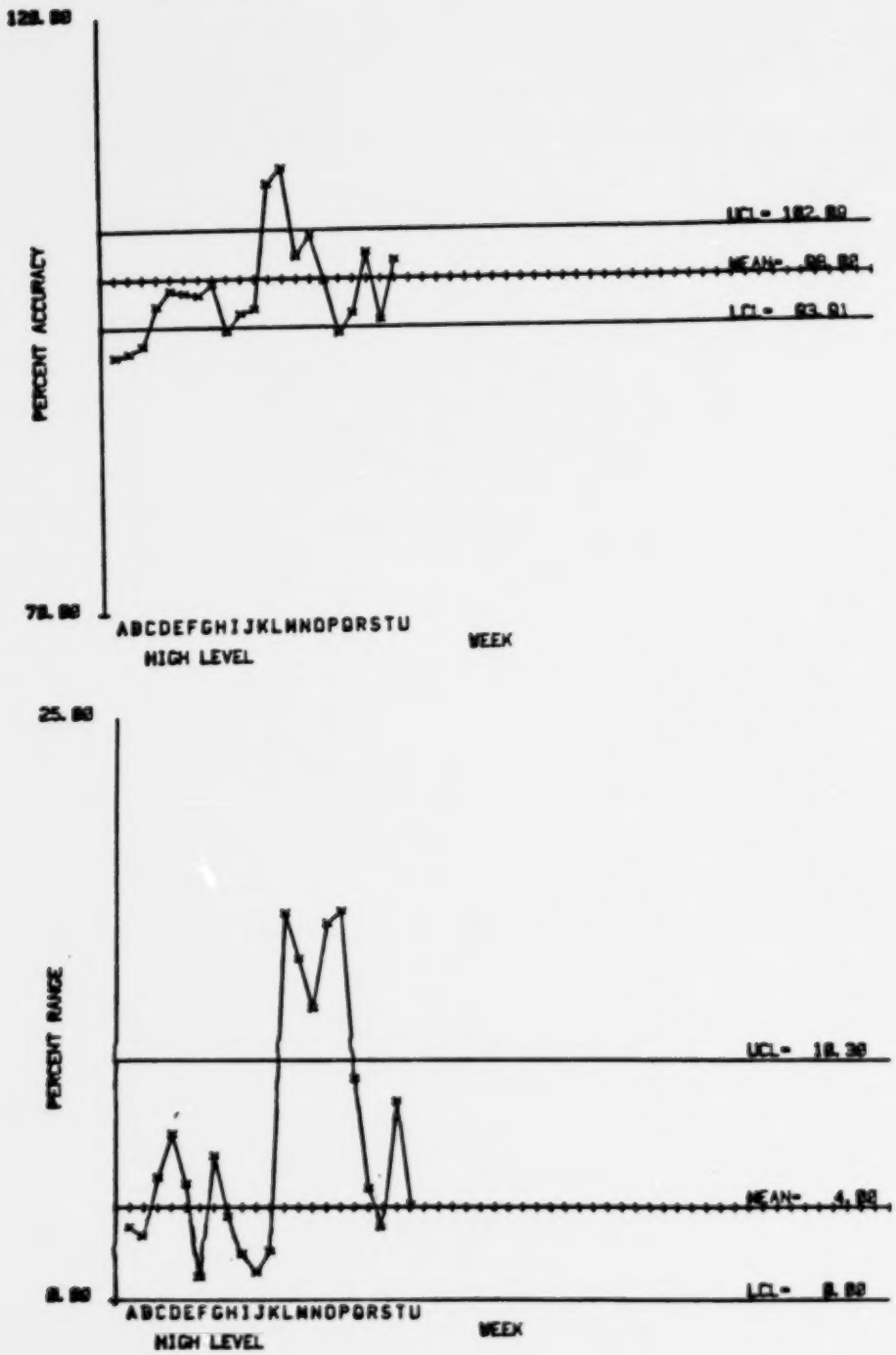


Figure 3-3. 1979 mean and range control charts (high level $SO_4^=$).

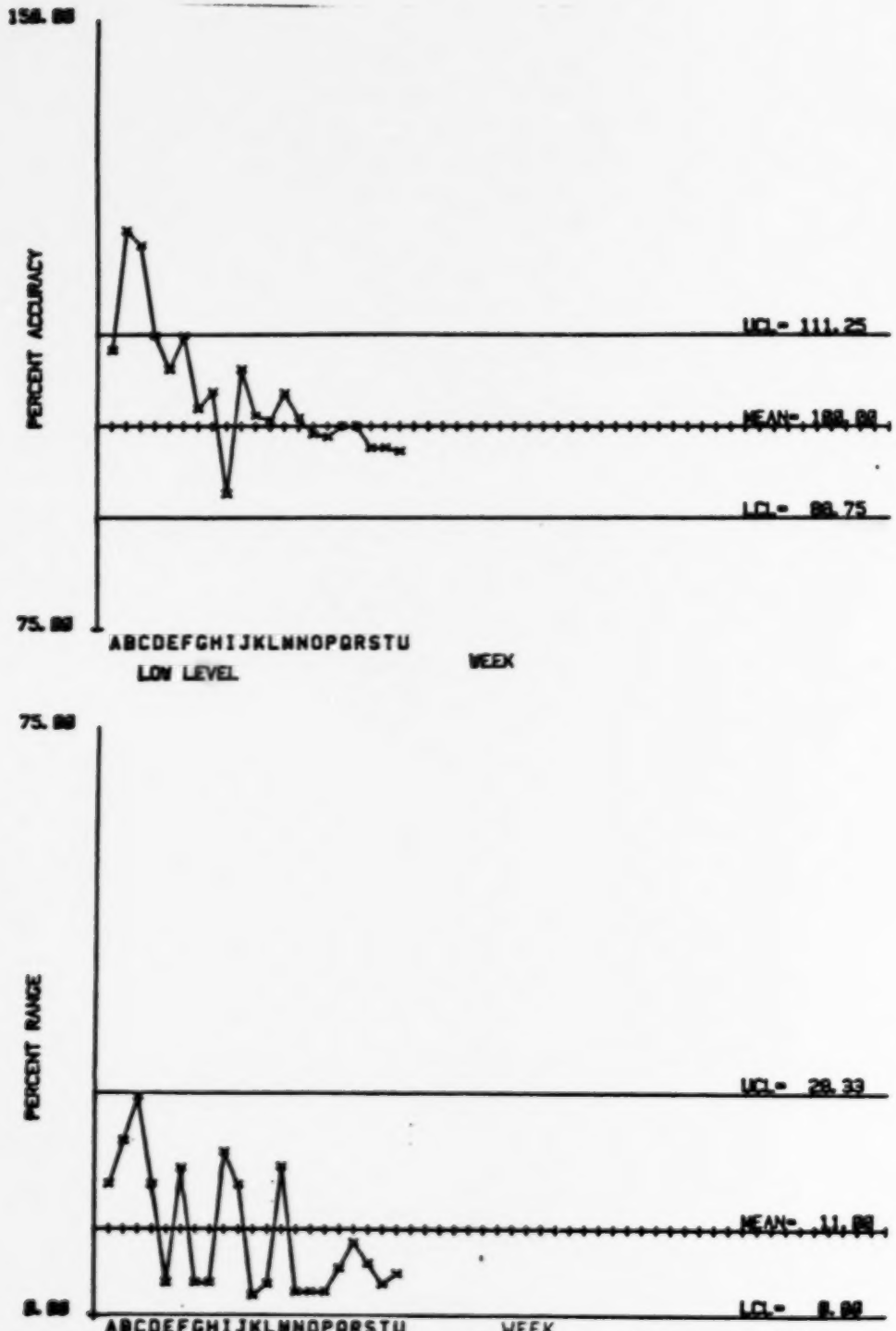


Figure 3-4. 1979 mean and range control charts (low level NO_3^-).

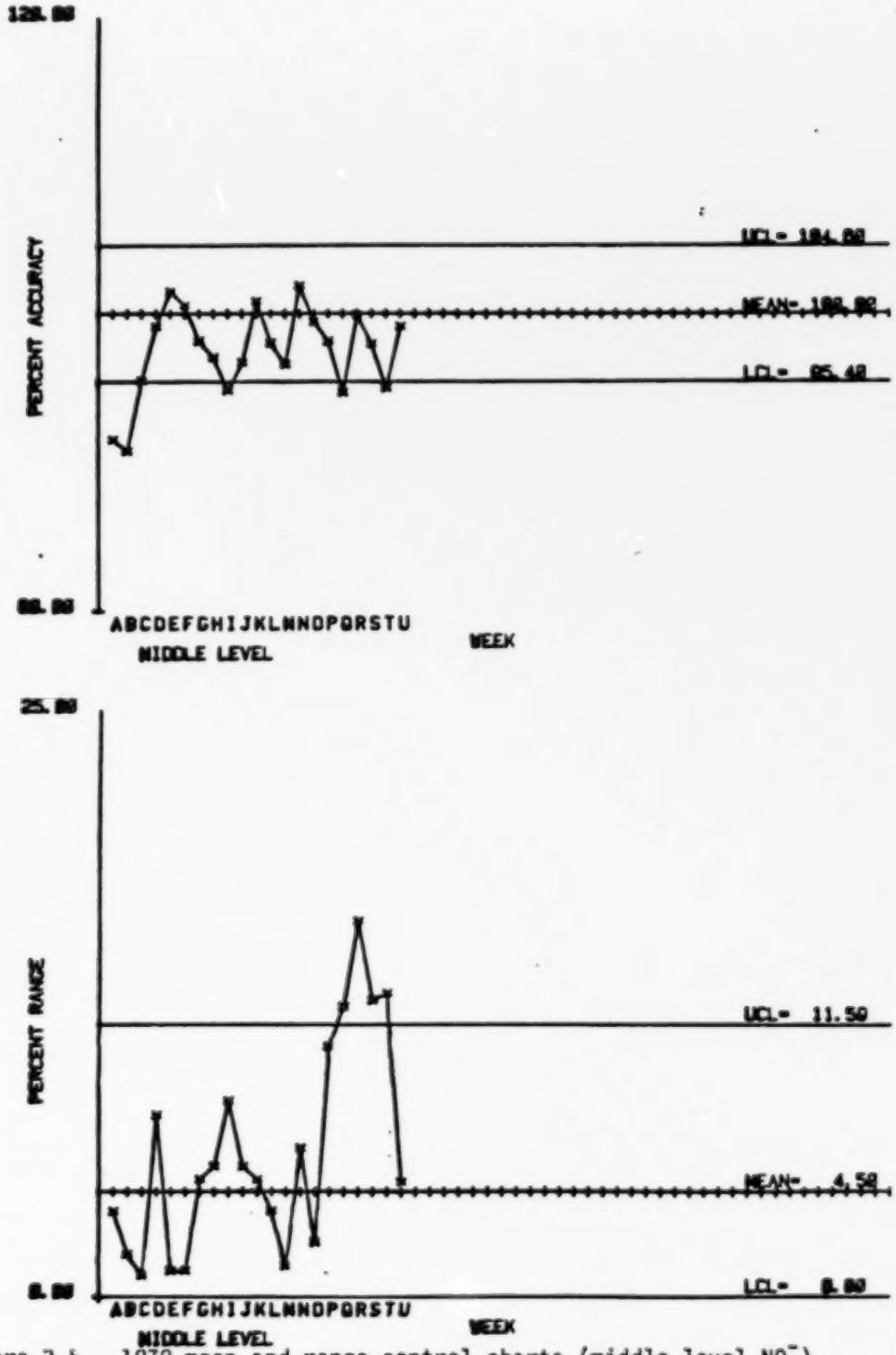
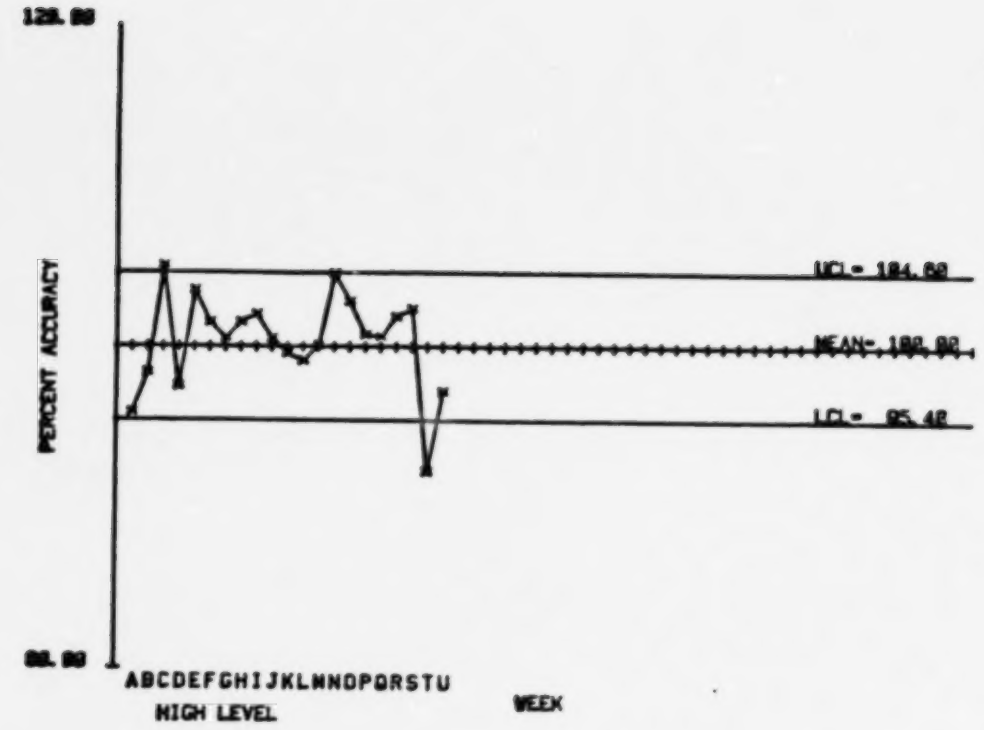


Figure 3-5. 1979 mean and range control charts (middle level NO_3^-).



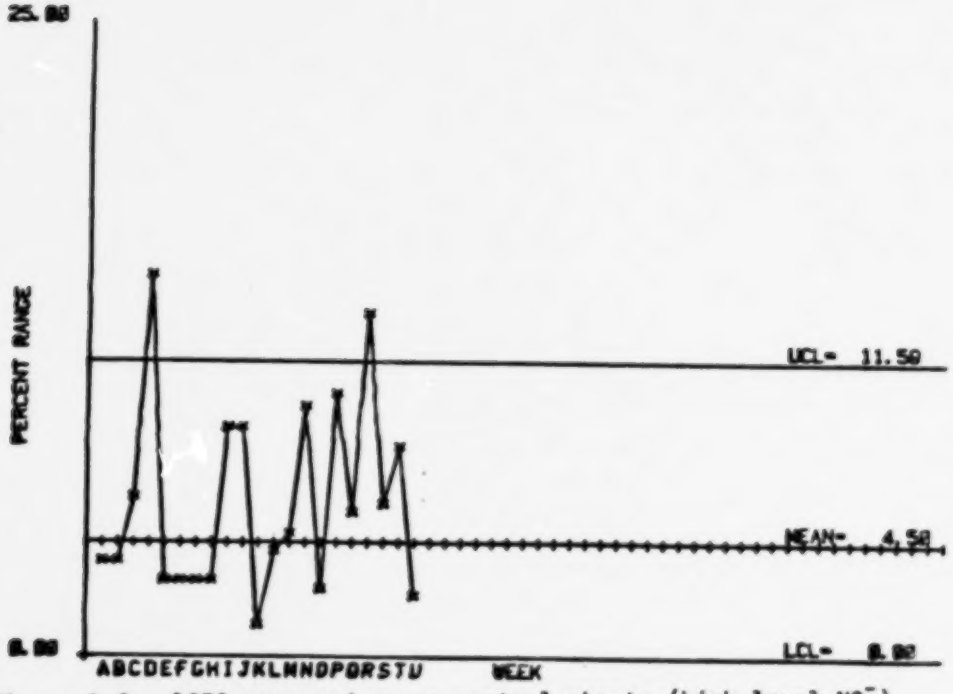


Figure 3-6. 1979 mean and range control charts (high level NO_3^-).

where X_H = the highest value of each set of 3

X_L = the lowest value of each set of 3

$\overline{X}_3$ = the average of the 3 values of each set.

The control charts reveal that very few plotted points exceed the control limits, and those exceeding the limits generally are isolated values. Hence, with few exceptions, laboratory results of the audit samples indicate that the analytical process was statistically as accurate as the 1978 analysis.

ANALYTICAL QUALITY ASSESSMENT

Precision and bias estimates previously discussed have been combined into an overall estimate of analytical quality. Based on the estimates of bias and precision, an individual pollutant value (minimum, maximum, or percentile) appearing in the data tables is expected to be correct (from an analysis standpoint) within the stated interval with a 95 percent confidence level.

The approximate upper and lower confidence limits (L_u and L_ℓ, respectively) are calculated as follows:

$$L_u = X(1 - B/100 + 1.96\ C_v/100) \quad (7a)$$

$$L_\ell = X(1 - B/100 - 1.96\ c_v/100) \quad (7b)$$

where X = the individual analysis value
B = bias, percent
C = coefficient of variation of individual analysis.

For example, the maximum sulfate value for Duluth, Minnesota, was 18.1 $\mu g/m^3$. In Table 3-3, the bias is -2.0% and the coefficient of variation for precision is 4.0%, so the resulting confidence limits are:

$$L_u = 18.1[1-(-2.0)/100 + (1.96)(4.0)/100] = 19.9 \quad (8a)$$

$$L_\ell = 18.1[1-(-2.0)/100 - (1.96)(4.0)/100] = 17.0 \quad (8b)$$

It is emphasized that estimates determined by the above formulae consider only variability from sample preparation (i.e., cutting and extraction) and sample analysis. Also, it is assumed the bias is constant, and the inherent variability due to sample preparation and sample analysis remains unchanged. Furthermore, if additional information were known concerning variation due to factors such as flow rate or other variables of sampling, then these confidence intervals would be wider. As a result, all confidence limits are underestimates of the variability of the total measurement process, including sampling and analysis.

Estimates of bias and precision for the 1979 analytical results are summarized in Table 3-3. Corresponding values for previous years are presented in earlier reports.

TABLE 3-3. ANALYTICAL PRECISION AND BIAS

Ion	Concentration Range ($\mu g/m^3$)	Bias (%)	Precision (%)
Nitrate	<3	+4.1	±7
	3-6	-2.5	±3
	>6	+0.4	±4
Sulfate	<6	-6.7	±6
	6-20	-2.0	±4
	>20	-2.9	±1

SECTION 4

NATIONAL SUMMARY OF AIR QUALITY MEASUREMENTS

Data presented in Tables 4-1 and 4-2 are annual cumulative frequency distributions by ion of individual results for urban and nonurban locations, respectively. In the first line of Table 4-1, the number, 3900, is the number of valid 24-hour samples analyzed for nitrate in 1971. The next entry is the minimum value detected that year, and "LD" means below the minimum detectable level of the instrument. The next seven entries are the 10 through 99 percentile values. For example, the 90 percentile value of 5.02 indicates that 90 percent of the 3900 values; i.e., 0.90 x 3900 = 3510, were equal to or less than 5.02 $\mu g/m^3$. The next entry is the maximum annual value. Arithmetic means and standard deviations, and geometric means and geometric standard deviations are presented in the last four columns in the table. Comparison among years for a given pollutant provides a relative indication of national trends.

The NASN annual arithmetic mean concentrations for nitrate and sulfate ions are shown in Figures 4-1 and 4-2, respectively. It is clear from Figure 4-1 that NASN nitrate concentrations on a nationwide basis increased substantially during the 1970's. In areas classified as urban, the average rate of increase was 6.2% per year, while nitrate ion in non-urban areas increased at an average rate of 9.6% per year during the nine-year period. Daniel's Test for Trend[6] showed significance at the 99% probability level for the positive trends in both urban and nonurban nitrate ion concentrations. Average NASN sulfate concentrations, shown in Figure 4-2, do not exhibit a consistent trend through the entire period, but it does appear that sulfate ion concentrations in both urban and nonurban areas have increased since 1976.

Since typical levels of these pollutants, especially sulfate, may be geographically dependent, the national frequency distribution is not helpful for judging the localized contribution and relative severity of these pollutants for an individual site. Therefore, local site analyses should be performed with data from surrounding sites within the same general geographical area. Data for each site are presented in Section 5. Also, some of the variability from year to year in the national summary tables may be attributed to different sets of sites being used in the summarization, depending upon the completeness criteria for valid data as described in Section 5 and changes in state and local agency participation in the networks over the years.

TABLE 4-1. URBAN NATIONAL CUMULATIVE FREQUENCY DISTRIBUTIONS

Ion	Year	Number of Samples	Min.	Percent of time concentration ($\mu g/m^3$) is equal to or less than							Max.	Arithmetic statistics		Geometric statistics	
				10	30	50	70	90	95	99		Mean	Std. Dev.	Mean	Std. Dev.
NO_3^-	1971	3900	LD	0.69	1.55	2.29	3.22	5.02	6.48	11.85	26.17	2.77	2.30	2.13	2.06
	1972	5519	LD	0.66	1.58	2.47	3.55	5.90	7.88	13.50	24.99	3.05	2.61	2.32	2.10
	1973	4775	LD	0.81	1.71	2.58	3.65	6.24	8.31	14.61	37.36	3.25	2.87	2.44	2.13
	1974	4562	LD	0.83	1.74	2.54	3.63	6.46	8.62	17.50	54.89	3.36	3.40	2.36	2.32
	1975	4113	0.20	0.96	2.00	2.91	4.12	7.18	9.90	17.07	33.71	3.73	3.31	2.79	2.15
	1976	3817	0.08	1.07	1.99	2.80	3.83	6.48	9.53	20.65	43.16	3.71	3.83	2.58	2.34
	1977	4531	0.07	1.07	2.09	2.99	4.15	6.76	10.40	20.63	97.67	3.89	3.97	2.87	2.18
	1978	3610	LD	1.08	2.21	3.24	4.56	7.78	11.18	22.91	56.96	4.22	4.10	3.07	2.26
	1979	2484	LD	1.10	2.48	3.87	5.62	9.57	12.05	18.42	36.12	4.77	3.88	3.51	2.32
$SO_4^=$	1971	3916	LD	3.4	5.7	8.0	10.9	18.0	22.0	33.5	69.2	9.6	6.8	7.84	1.89
	1972	5519	LD	3.9	6.7	9.4	12.7	20.3	25.4	37.9	75.9	11.1	7.7	9.15	1.87
	1973	4774	LD	3.9	6.3	8.1	10.9	17.5	22.7	35.4	162.0	9.9	7.0	8.06	1.89
	1974	4564	LD	3.9	6.3	8.3	11.3	17.9	22.8	34.8	69.1	10.0	6.7	8.34	1.83
	1975	4110	0.2	3.5	6.1	8.3	11.5	18.1	23.8	35.8	72.6	10.0	7.0	8.22	1.88
	1976	3871	0.2	3.1	5.4	7.4	9.9	16.5	20.0	29.2	66.7	8.8	5.8	7.33	1.83
	1977	4531	0.7	3.1	5.7	7.6	10.3	17.1	20.9	29.9	76.4	9.1	6.1	7.44	1.72
	1978	3610	LD	3.1	5.7	7.8	10.6	16.6	20.4	34.5	228.4	9.4	7.5	7.55	1.95
	1979	2484	LD	4.1	6.9	9.2	11.9	17.8	21.2	31.9	87.7	10.4	6.3	8.80	1.83

LD: Less than detectable

TABLE 4-2. NONURBAN NATIONAL CUMULATIVE FREQUENCY DISTRIBUTIONS

Ion	Year	Number of Samples	Min.	Percent of time concentration ($\mu g/m^3$) is equal to or less than							Max.	Arithmetic statistics		Geometric statistics	
				10	30	50	70	90	95	99		Mean	Std. Dev.	Mean	Std. Dev.
NO_3^-	1971	671	LD	0.06	0.31	0.71	1.20	2.19	2.67	3.81	6.04	0.95	0.95	0.68	2.26
	1972	928	LD	LD	0.15	0.50	1.01	2.08	2.59	4.19	6.59	0.79	0.92	0.52	2.52
	1973	831	LD	0.04	0.28	0.71	1.26	2.35	2.83	4.47	6.67	0.99	1.02	0.69	2.34
	1974	706	LD	0.12	0.37	0.83	1.37	2.52	3.16	5.13	6.65	1.10	1.07	0.79	2.25
	1975	630	0.20	0.20	0.20	0.73	1.41	2.74	3.28	4.85	11.85	1.13	1.16	0.78	2.35
	1976	467	LD	0.10	0.36	0.82	1.51	2.82	3.54	4.73	6.15	1.18	1.16	0.84	2.27
	1977	681	LD	0.17	0.55	1.05	1.81	3.07	3.84	5.22	11.57	1.39	1.26	0.85	3.21
	1978	458	LD	0.30	0.59	1.07	2.03	3.77	4.74	8.09	11.77	1.69	1.72	1.06	2.78
	1979	234	0.11	0.43	0.86	1.46	2.57	4.59	5.37	10.93	13.80	2.17	2.08	1.48	2.46
$SO_4^=$	1971	686	0.4	1.5	3.0	4.7	7.2	11.8	15.5	23.6	35.4	6.0	4.9	4.7	2.03
	1972	929	LD	1.4	2.9	5.2	7.8	13.7	17.4	24.8	42.7	6.6	5.4	5.1	2.05
	1973	831	LD	1.3	2.7	4.4	6.3	12.0	17.0	29.8	53.2	6.0	5.9	4.2	2.29
	1974	706	0.1	1.4	2.6	4.8	7.2	12.2	16.6	27.0	90.0	6.2	6.2	4.4	2.30
	1975	630	0.2	0.7	2.1	4.0	6.4	11.6	15.2	28.7	48.3	5.5	5.7	3.8	2.36
	1976	493	0.2	0.9	1.8	4.0	6.5	11.3	13.9	21.3	36.3	5.3	4.9	3.8	2.22
	1977	681	LD	1.2	2.5	4.7	7.4	12.8	17.1	24.6	43.3	6.1	5.4	4.0	2.72
	1978	458	LD	1.2	3.0	4.9	7.2	13.4	17.0	21.0	38.5	6.2	5.3	4.2	2.71
	1979	234	LD	3.0	4.1	6.6	8.6	13.2	18.9	29.0	39.1	7.7	5.5	6.1	2.11

LD: Less than detectable

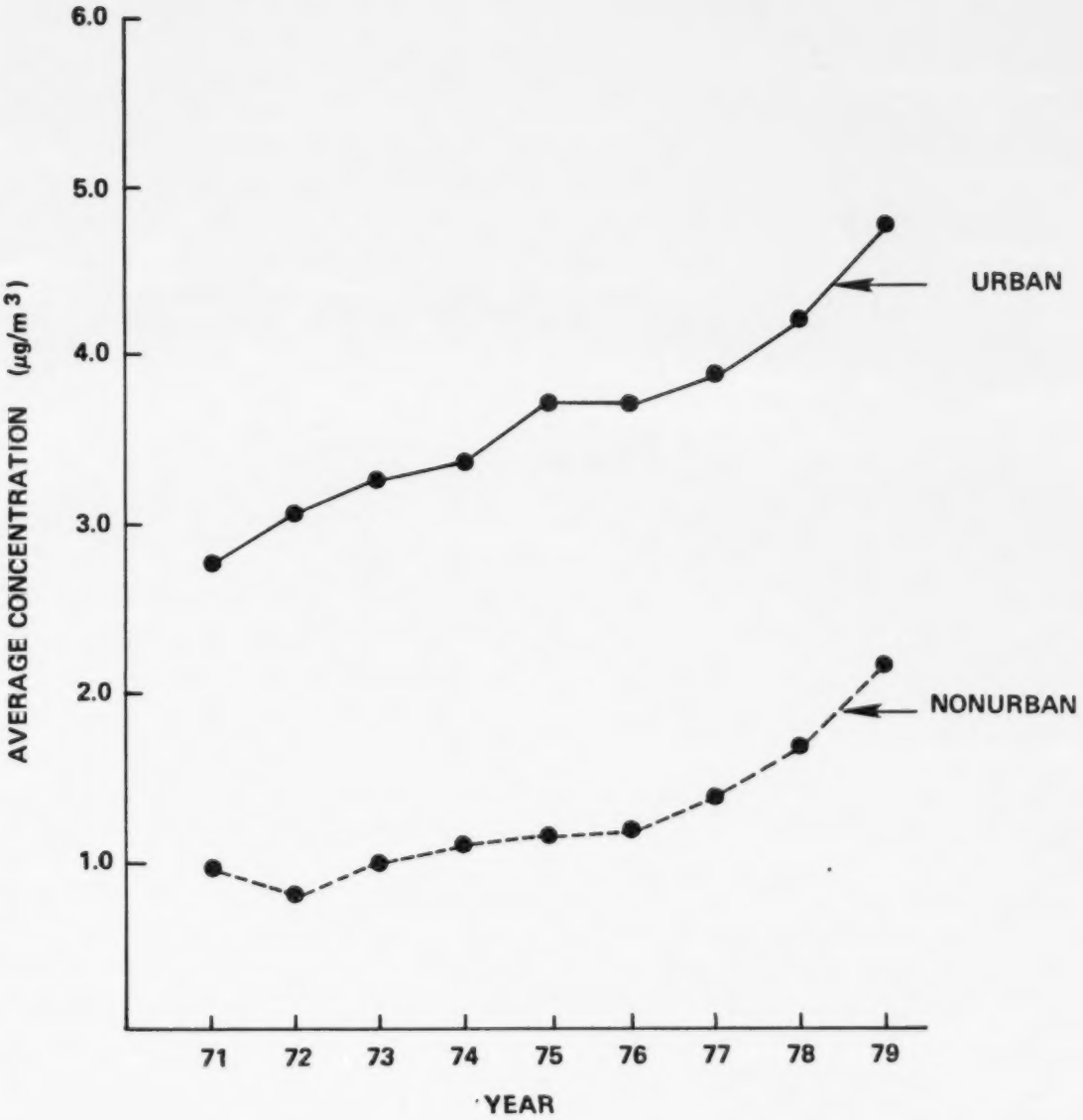


Figure 4-1. Annual Arithmetic Average Concentrations for NASN Nitrate Ion

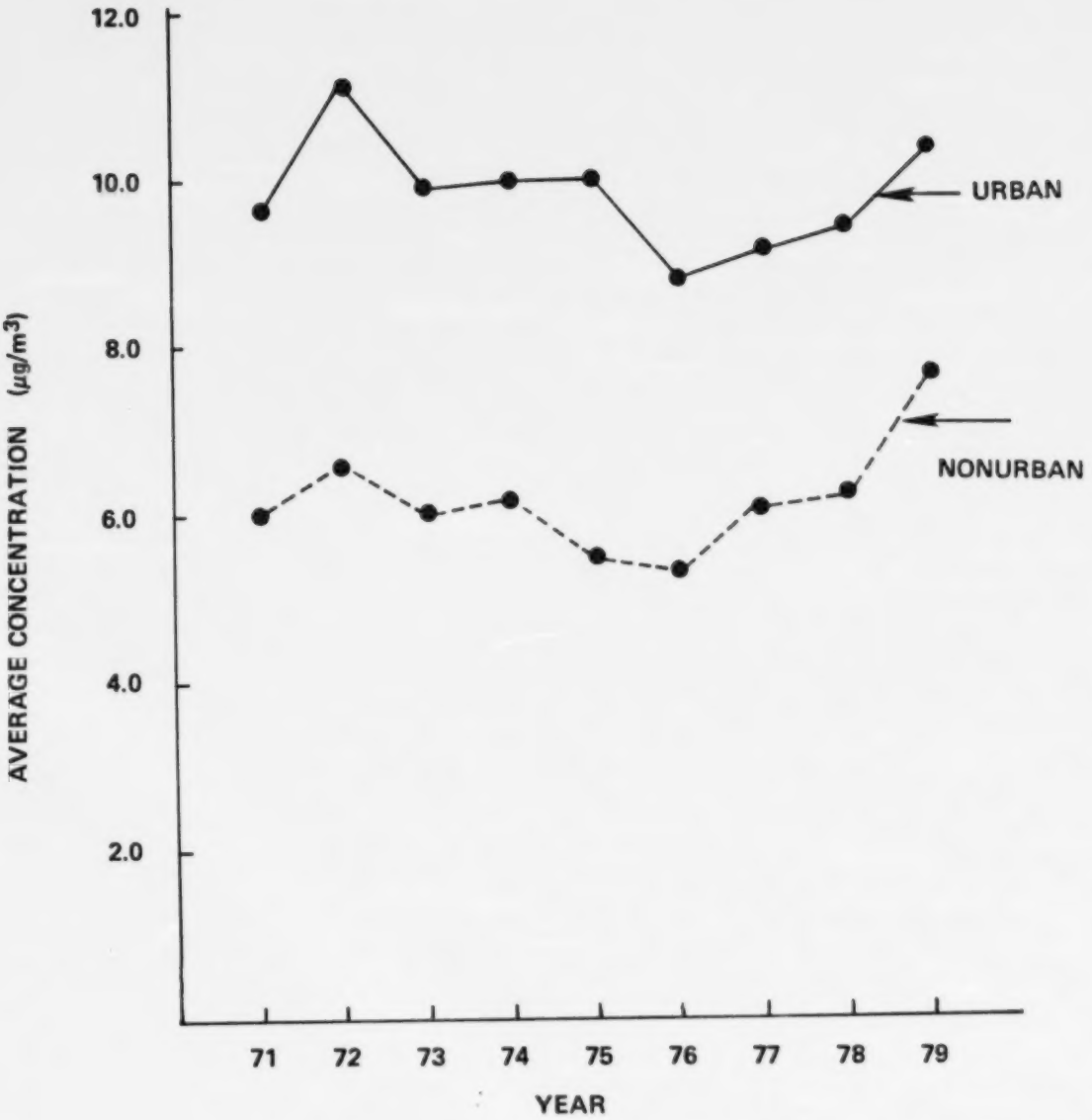


Figure 4-2. Annual Arithmetic Average Concentrations for NASN Sulfate Ion

SECTION 5

DATA TABLES

Data are arranged by urban and nonurban sites. Each monitoring site is assigned a unique code number as described in the SAROAD Station Coding Manual.[7]

The data are presented in the same format as previously described for national summaries. Values are expressed in micrograms of pollutant per cubic meter of air. Data are judged to be valid (i.e., representative of an annual sample) if there were at least five valid samples obtained each quarter of the year. In addition, when no samples were collected during one month of a quarter, at least two valid samples must have been collected during the other two months to validate the data. In order to provide a more comprehensive data summary, some data which are not valid, as identified by an asterisk following the year, are presented if the following three conditions were satisfied:

1. A total of at least 15 samples were collected that year

2. Data for at least two quarters were valid

3. At least one sample was obtained in each of the other two quarters

Values below the analytical limits of detection are reported as "LD's" in the data tables, and a yearly mean is calculated by replacing the LD's with a value equal to one-half the value of the LD. If more than 25 percent of the individual values during a year are below the lower analytical limits, the summary statistics are not calculated. When more than 50 percent of the individual results during a year are below the lower analytical limits, only the minimum, maximum, and number of results below the detection limit are shown.

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N
N O 3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
ALASKA										
ANCHORAGE										
020040003A01	79*	15	.24	.46	.53	.88	.90	1.04	1.34	1.52
ARIZONA										
DOUGLAS										
030240004A01	79	26	.69	1.04	1.16	1.45	1.53	1.75	2.10	2.54
PHOENIX										
030600002A01	79*	20	1.59	2.28	3.42	4.88	5.42	5.56	6.42	6.88
TUCSON										
030860001A01	79	26	1.53	1.61	2.05	2.65	3.12	3.72	4.45	4.69
CALIFORNIA										
ANAHEIM										
050230001A01	79*	20	2.05	3.55	8.27	8.99	10.34	11.51	14.02	14.60
BERKELEY										
050740001A01	79*	20	.83	1.06	1.52	1.64	2.01	2.62	2.88	3.79
FRESNO										
052800002A01	79*	20	2.60	4.10	4.96	5.66	5.91	6.72	9.12	10.72
LOS ANGELES										
054180001A01	79*	19	2.91	4.05	10.47	12.39	12.72	13.50	14.45	15.02
ONTARIO										
055380001A01	79*	21	1.17	4.23	8.93	16.95	17.07	19.82	21.43	29.95
SACRAMENTO										
056580001A01	79*	21	.05	.44	2.02	3.70	4.18	6.05	9.12	11.28
SAN BERNARDINO										
056680001A01	79*	20	2.02	7.55	11.92	17.49	19.88	25.36	27.34	29.37
SAN DIEGO										
056800004A01	79*	20	1.97	2.34	5.09	8.07	9.31	10.28	12.42	12.82
SAN JOSE										
056980004A01	79*	20	1.44	2.04	2.56	2.85	3.12	3.97	7.82	11.28
SANTA ANA										
057180001A01	79*	20	1.67	3.56	7.06	9.34	11.31	12.27	13.97	19.96
CONNECTICUT										
BRIDGEPORT										
070060001A01	79	27	.96	1.54	2.14	3.80	3.93	6.18	7.89	9.96
NEW HAVEN										
070700123A01	79	27	.83	1.55	2.23	4.16	4.94	6.33	9.44	9.65
WATERBURY										
071240123A01	79	27	.65	1.48	2.30	3.60	4.07	4.60	5.10	5.32

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ALASKA									
ANCHORAGE									
020040003A01	79*	15	1.52	1.70	1.70	.877	.457	.765	1.752
ARIZONA									
DOUGLAS									
030240004A01	79	26	3.06	3.06	3.73	1.659	.728	1.531	1.490
PHOENIX									
030600002A01	79*	20	7.12	9.35	9.35	4.895	1.914	4.498	1.560
TUCSON									
030860001A01	79	26	5.75	5.75	5.80	3.117	1.318	2.864	1.521
CALIFORNIA									
ANAHEIM									
050230001A01	79*	20	16.16	22.74	22.74	10.205	4.681	9.074	1.716
BERKELEY									
050740001A01	79*	20	5.21	12.30	12.30	2.644	2.501	2.114	1.837
FRESNO									
052800002A01	79*	20	12.74	17.40	17.40	7.063	3.541	6.387	1.566
LOS ANGELES									
054180001A01	79*	19	16.84	18.42	18.42	11.497	4.258	10.446	1.652
ONTARIO									
055380001A01	79*	21	33.25	35.42	35.42	16.111	9.258	12.825	2.242
SACRAMENTO									
056580001A01	79*	21	14.44	15.29	15.29	5.081	4.383	3.135	3.554
SAN BERNARDINO									
056680001A01	79*	20	34.58	36.12	36.12	18.889	9.459	16.031	1.954
SAN DIEGO									
056800004A01	79*	20	13.28	14.17	14.17	8.153	4.020	6.999	1.849
SAN JOSE									
056980004A01	79*	20	12.87	20.26	20.26	5.296	4.858	3.961	2.069
SANTA ANA									
057180001A01	79*	20	21.27	21.47	21.47	10.898	5.520	9.371	1.859
CONNECTICUT									
BRIDGEPORT									
070060001A01	79	27	12.36	12.36	13.23	5.076	3.559	3.959	2.094
NEW HAVEN									
070700123A01	79	27	11.07	11.07	12.15	5.137	3.494	3.982	2.148
WATERBURY									
071240123A01	79	27	9.59	9.59	11.28	3.924	2.443	3.247	1.932

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

URBAN
NO3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
FLORIDA										
DAVIE										
100910002A01	79	29	.60	.80	1.28	1.91	2.66	2.75	2.90	4.20
JACKSONVILLE										
101960049A01	79	26	1.09	1.47	1.97	2.41	2.79	3.08	3.87	3.98
TAMPA										
104360002A01	79*	22	.82	1.74	2.62	3.47	3.73	3.82	5.61	6.47
HAWAII										
HONOLULU										
120120001A01	79	29	.28	.28	.31	.48	.59	.66	.92	1.23
INDIANA										
EVANSVILLE										
151300006A01	79*	21	2.27	3.34	4.90	5.70	6.70	7.07	8.89	9.29
GARY										
151520001A01	79*	21	.66	.96	2.79	4.91	6.58	7.31	7.78	9.28
HAMMOND										
151780001A01	79*	23	1.35	2.52	4.58	6.61	8.30	8.93	9.66	12.51
INDIANAPOLIS										
152040002A01	79*	18	2.84	2.97	4.68	5.24	6.14	8.19	8.28	9.88
SOUTH BEND										
153880002A01	79*	21	.49	1.99	4.17	6.41	6.81	7.91	8.33	11.10
TERRE HAUTE										
154080001A01	79*	20	1.98	2.34	4.54	5.86	6.56	7.06	7.30	8.72
IOWA										
DAVENPORT										
161060001A01	79*	22	.68	1.83	2.57	4.93	6.23	6.61	9.46	11.92
DES MOINES										
161180001A01	79*	23	1.35	1.71	2.71	3.84	3.99	4.32	5.63	11.77
KENTUCKY										
COVINGTON										
180800001A01	79	30	1.90	2.55	3.70	4.91	5.58	5.90	6.19	8.28
LEXINGTON										
182300003A01	79	29	1.44	3.38	3.91	5.70	5.90	6.26	7.92	9.01
LOUISVILLE										
182380035A01	79*	16	2.36	2.85	3.35	5.39	5.43	6.47	8.21	8.37
MAINE										
PORTLAND										
200960004A01	79	23	.39	.41	.97	2.30	2.39	2.76	3.73	4.39

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
FLORIDA									
DAVIE									
100910002A01	79	29	5.89	5.89	6.27	2.336	1.478	1.941	1.871
JACKSONVILLE									
101960049A01	79	26	4.70	4.70	6.38	2.816	1.229	2.578	1.539
TAMPA									
104360002A01	79*	22	6.64	12.05	12.05	4.002	2.371	3.458	1.753
HAWAII									
HONOLULU									
120120001A01	79	29	1.66	1.66	1.78	.653	.422	.548	1.800
INDIANA									
EVANSVILLE									
151300006A01	79*	21	9.81	11.55	11.55	6.305	2.403	5.853	1.503
GARY									
151520001A01	79*	21	9.38	12.49	12.49	5.441	3.139	4.298	2.239
HAMMOND									
151780001A01	79*	23	13.40	21.14	21.14	7.592	4.529	6.369	1.885
INDIANAPOLIS									
152040002A01	79*	18	11.50	15.24	15.24	6.639	3.166	6.035	1.557
SOUTH BEND									
153880002A01	79*	21	12.05	12.67	12.67	6.378	3.358	5.236	2.130
TERRE HAUTE									
154080001A01	79*	20	9.22	9.68	9.68	5.763	2.302	5.243	1.610
IOWA									
DAVENPORT									
161060001A01	79*	22	12.76	16.08	16.08	6.081	4.084	4.739	2.177
DES MOINES									
161180001A01	79*	23	15.62	24.09	24.09	5.283	5.288	3.909	2.077
KENTUCKY									
COVINGTON									
180800001A01	79	30	11.05	11.05	14.70	5.459	2.655	4.949	1.562
LEXINGTON									
182300003A01	79	29	9.74	9.74	14.03	5.805	2.689	5.219	1.627
LOUISVILLE									
182380035A01	79*	16	10.40	13.70	13.70	5.934	3.123	5.252	1.663
MAINE									
PORTLAND									
200960004A01	79	23	5.30	5.38	5.38	2.356	1.570	1.779	2.314

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N
N O 3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
MARYLAND										
BALTIMORE										
210120001A01	79	26	1.21	2.20	3.99	4.50	5.99	6.39	7.17	7.59
MASSACHUSETTS										
BOSTON										
220240012A01	79*	20	1.20	1.26	1.81	3.20	4.02	4.95	5.61	6.43
CAMBRIDGE										
220360001A01	79*	21	.77	1.10	2.32	3.02	3.72	4.16	4.99	7.13
FALL RIVER										
220580001A01	79*	15	.72	1.06	1.87	3.46	4.45	4.97	6.09	10.21
NEW BEDFORD										
221500002A01	79	27	.49	1.08	1.73	2.73	2.88	3.26	5.36	7.50
SPRINGFIELD										
222160002A01	79*	23	1.23	1.48	2.30	4.28	5.06	5.41	6.02	9.87
WORCHESTER										
222640004A01	79	27	.81	1.12	2.18	3.54	3.62	4.48	4.71	7.20
MINNESOTA										
DULUTH										
241040017A01	79*	21	.28	.47	.88	1.56	1.82	2.03	3.71	4.94
NEBRASKA										
OMAHA										
281880034A01	79	29	.71	1.34	2.48	3.95	4.26	5.54	5.97	7.36
NEVADA										
LAS VEGAS										
290320001A01	79*	25	.37	1.08	1.95	3.17	3.79	5.19	5.50	6.57
RENO										
290480001A01	79	30	.42	.81	1.71	2.37	2.55	2.99	3.61	3.88
NEW HAMPSHIRE										
CONCORD										
300120002A01	79*	15	.44	.53	.98	1.41	1.42	1.84	2.45	3.19
NEW JERSEY										
ELIZABETH										
311300002A01	79*	22	1.84	2.09	3.10	5.40	6.09	6.26	7.55	9.67
GLASSBORO										
311700001A01	79*	22	2.40	2.76	4.05	5.11	6.16	6.58	7.05	8.07
JERSEY CITY										
312320001A01	79*	16	1.77	1.77	3.83	5.80	9.25	9.57	10.41	11.97

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
MARYLAND									
BALTIMORE									
210120001A01	79	26	10.88	10.88	12.48	5.336	2.613	4.738	1.677
MASSACHUSETTS									
BOSTON									
220240012A01	79*	20	8.78	10.07	10.07	3.961	2.490	3.264	1.926
CAMBRIDGE									
220360001A01	79*	21	7.40	9.23	9.23	3.724	2.189	3.138	1.867
FALL RIVER									
220580001A01	79*	15	10.21	10.35	10.35	4.333	3.184	3.247	2.297
NEW BEDFORD									
221500002A01	79	27	7.82	7.82	8.58	3.355	2.365	2.623	2.095
SPRINGFIELD									
222160002A01	79*	23	11.78	15.55	15.55	5.007	3.604	3.989	2.000
WORCHESTER									
222640004A01	79	27	8.67	8.67	8.76	3.757	2.287	3.096	1.943
MINNESOTA									
DULUTH									
241040017A01	79*	21	6.96	8.21	8.21	2.256	2.147	1.559	2.414
NEBRASKA									
OMAHA									
281880034A01	79	29	13.85	13.85	17.52	4.852	3.941	3.708	2.125
NEVADA									
LAS VEGAS									
290320001A01	79*	25	6.73	7.55	7.55	3.563	2.098	2.836	2.163
RENO									
290480001A01	79	30	6.27	6.27	8.75	2.621	1.704	2.171	1.909
NEW HAMPSHIRE									
CONCORD									
300120002A01	79*	15	3.19	3.63	3.63	1.626	.972	1.360	1.895
NEW JERSEY									
ELIZABETH									
311300002A01	79*	22	10.98	11.02	11.02	5.516	2.764	4.842	1.715
GLASSBORO									
311700001A01	79*	22	10.08	12.15	12.15	5.654	2.397	5.208	1.516
JERSEY CITY									
312320001A01	79*	16	12.12	13.36	13.36	7.092	3.987	5.813	2.026

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N
N O 3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
NEW JERSEY										
NEWARK										
313480001A01	79	26	1.42	2.33	3.99	6.26	7.58	9.16	10.03	10.29
TRENTON										
315400001A01	79*	18	2.36	2.84	3.87	5.82	6.82	8.59	8.60	9.83
NEW YORK										
ALBANY										
330040001A01	79*	16	.73	1.45	2.22	3.04	4.53	4.71	5.00	5.43
BUFFALO										
330660001A01	79*	19	1.14	2.05	3.01	4.97	5.29	5.82	5.91	6.37
NIAGARA FALLS										
334740001A01	79	30	1.37	1.94	3.59	4.69	5.07	5.48	6.78	8.08
ROCHESTER										
335760001A01	79*	19	1.68	2.03	3.23	4.50	4.77	4.93	5.20	5.75
SYRACUSE										
336620001A01	79*	27	.94	2.33	2.77	3.66	3.97	4.55	6.08	8.57
UTICA										
336880001A01	79	28	1.05	1.36	2.50	3.33	3.74	3.98	4.06	6.46
YONKERS										
337620001A01	79*	21	1.20	1.83	3.77	6.40	7.52	8.21	9.84	10.01
NORTH CAROLINA										
CHARLOTTE										
340700001A01	79	29	1.32	1.53	2.73	4.15	4.21	4.63	4.90	5.88
DURHAM										
341160001A01	79	28	1.12	2.25	2.55	3.42	3.76	4.14	4.73	5.16
MOREHEAD CITY										
342720002A01	79*	26	.54	1.09	1.50	1.86	2.06	2.34	2.59	2.82
WINSTON-SALEM										
344460002A01	79	25	1.49	1.70	2.68	4.19	4.64	5.01	6.62	7.06
OHIO										
AKRON										
360060014A01	79	25	1.58	3.98	4.83	6.58	6.91	7.30	7.60	8.60
CANTON										
361000001A01	79	27	1.84	2.95	4.77	5.60	6.13	6.87	8.08	9.11
CINCINNATI										
361220001A01	79	27	1.92	2.83	3.88	4.85	5.29	5.67	6.21	7.13
361220019A01	79*	17	2.54	2.65	3.10	3.85	4.36	4.78	5.22	5.68
CLEVELAND										
361300001A01	79*	25	1.62	3.10	4.51	6.26	6.84	7.80	8.33	8.80

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
NEW JERSEY									
NEWARK									
313480001A01	79	26	12.19	12.19	15.66	6.686	3.692	5.639	1.874
TRENTON									
315400001A01	79*	18	10.39	13.68	13.68	6.601	3.121	5.897	1.651
NEW YORK									
ALBANY									
330040001A01	79*	16	5.48	5.90	5.90	3.463	1.657	3.015	1.804
BUFFALO									
330660001A01	79*	19	7.97	12.76	12.76	4.882	2.608	4.268	1.738
NIAGARA FALLS									
334740001A01	79	30	9.67	9.67	12.96	5.065	2.529	4.479	1.687
ROCHESTER									
335760001A01	79*	19	7.04	11.97	11.97	4.595	2.225	4.184	1.555
SYRACUSE									
336620001A01	79*	27	9.24	9.24	10.85	4.402	2.500	3.788	1.770
UTICA									
336880001A01	79	28	7.05	7.05	10.76	3.646	2.050	3.180	1.714
YONKERS									
337620001A01	79*	21	10.97	11.04	11.04	6.200	3.234	5.227	1.917
NORTH CAROLINA									
CHARLOTTE									
340700001A01	79	29	6.54	6.54	7.06	3.834	1.560	3.494	1.585
DURHAM									
341160001A01	79	28	6.07	6.07	7.69	3.651	1.422	3.393	1.491
MOREHEAD CITY									
342720002A01	79*	26	3.68	3.68	4.49	2.050	.897	1.868	1.571
WINSTON-SALEM									
344460002A01	79	25	8.67	8.98	8.98	4.431	2.203	3.887	1.718
OHIO									
AKRON									
360060014A01	79	25	9.62	9.91	9.91	6.160	2.110	5.745	1.507
CANTON									
361000001A01	79	27	13.19	13.19	14.38	6.223	2.922	5.606	1.614
CINCINNATI									
361220001A01	79	27	10.32	10.32	10.96	5.264	2.165	4.881	1.487
361220019A01	79*	17	6.09	10.29	10.29	4.399	1.855	4.121	1.425
CLEVELAND									
361300001A01	79*	25	9.37	10.65	10.65	6.088	2.417	5.518	1.637

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N
N O 3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
OHIO										
COLUMBUS										
361460001A01	79*	24	2.29	2.60	4.49	5.61	6.28	6.43	7.10	8.03
MANSFIELD										
363840008A01	79	29	1.88	2.53	3.83	4.54	5.31	6.39	7.84	9.68
PORTSMOUTH										
365620002A01	79	28	.05	1.64	2.93	3.69	4.38	4.78	5.07	6.07
STEUBENVILLE										
366420012A01	79	28	.36	2.31	3.26	5.04	5.22	5.62	6.47	8.18
TOLEDO										
366600006A01	79	29	1.25	2.56	4.83	6.52	6.80	7.43	8.27	11.01
YOUNGSTOWN										
367760001A01	79	26	1.99	2.78	3.97	4.82	5.04	5.61	6.48	6.88
PUERTO RICO										
GUAYANILLA CO										
401100003A01	79*	22	.29	.36	.66	.77	.82	.89	1.04	1.18
GUAYNABO CO										
401140001A01	79*	18	.72	.79	.88	.96	1.37	1.45	1.78	2.53
PONCE										
401920002A01	79	22	.28	.29	.67	.81	.83	1.01	1.09	1.30
SAN JUAN CO										
402160003A01	79	26	.39	.57	.65	.78	1.01	1.06	1.23	2.07
TOA BAJA CO										
402320002A01	79	27	.28	.44	.65	.76	.78	.95	1.05	1.46
RHODE ISLAND										
EAST PROVIDENC										
410120008A01	79*	23	.84	1.07	2.66	3.35	3.55	4.14	4.82	6.73
SOUTH CAROLINA										
GREENVILLE										
421180001A01	79*	21	1.53	1.57	2.10	3.40	3.58	3.96	5.05	5.83
TENNESSEE										
CHATTANOOGA										
440380020A01	79	30	.59	1.68	2.85	3.66	3.88	4.08	5.28	5.84
MEMPHIS										
442340013A01	79*	17	.40	1.23	2.27	3.51	3.77	4.58	5.91	6.61
VIRGINIA										
NORFOLK										
482140001A01	79	29	1.70	2.36	2.84	3.53	3.82	4.57	4.96	5.56

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
OHIO									
COLUMBUS									
361460001A01	79*	24	9.01	10.11	10.11	5.760	1.979	5.403	1.463
MANSFIELD									
363840008A01	79	29	9.99	9.99	14.06	5.621	2.810	5.025	1.618
PORTSMOUTH									
365620002A01	79	28	7.83	7.83	8.75	3.953	1.994	3.066	2.758
STEUBENVILLE									
366420012A01	79	28	11.95	11.95	13.14	5.140	2.791	4.357	1.951
TOLEDO									
366600006A01	79	29	18.05	18.05	18.74	7.111	4.056	6.140	1.767
YOUNGSTOWN									
367760001A01	79	26	7.85	7.85	9.99	5.022	1.854	4.694	1.466
PUERTO RICO									
GUAYANILLA CO									
401100003A01	79*	22	1.30	1.31	1.31	.790	.287	.735	1.498
GUAYNABO CO									
401140001A01	79*	18	2.58	3.04	3.04	1.408	.715	1.266	1.584
PONCE									
401920002A01	79	22	1.50	2.49	2.49	.885	.479	.779	1.695
SAN JUAN CO									
402160003A01	79	26	2.50	2.50	2.68	1.060	.642	.924	1.662
TOA BAJA CO									
402320002A01	79	27	2.64	2.64	5.56	1.060	1.014	.857	1.789
RHODE ISLAND									
EAST PROVIDENC									
410120008A01	79*	23	6.90	7.15	7.15	3.650	1.856	3.146	1.818
SOUTH CAROLINA									
GREENVILLE									
421180001A01	79*	21	5.95	6.83	6.83	3.488	1.600	3.146	1.602
TENNESSEE									
CHATTANOOGA									
440380020A01	79	30	6.74	6.74	12.56	3.933	2.249	3.397	1.778
MEMPHIS									
442340013A01	79*	17	7.48	8.43	8.43	3.882	2.236	3.156	2.120
VIRGINIA									
NORFOLK									
482140001A01	79	29	6.79	6.79	8.55	3.953	1.512	3.701	1.445

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 81 - UG/CU METER (25 C)

URBAN
NO3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
WASHINGTON										
SPOKANE										
492040001A01	79*	25	1.17	1.34	1.73	2.27	2.36	2.81	3.28	4.32
WISCONSIN										
EAU CLAIRE										
510840002A01	79	29	.33	.79	1.32	2.24	2.72	3.44	4.19	6.31
KENOSHA										
511540003A01	79	27	.59	1.04	2.20	5.08	6.17	7.28	8.88	10.26
MADISON										
511860001A01	79*	26	1.01	1.80	2.40	3.23	5.77	6.18	9.32	11.17
MILWAUKEE										
512200099A01	79	29	1.07	1.43	3.73	5.76	6.65	7.78	10.38	12.21
RACINE										
512880002A01	79	28	.62	1.15	2.86	5.52	6.47	7.95	9.21	11.53
SUPERIOR										
513480006A01	79	27	.28	.42	.74	1.62	1.67	3.04	4.95	5.81

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
WASHINGTON									
SPOKANE									
492040001A01	79*	25	4.61	6.80	6.80	2.548	1.308	2.299	1.561
WISCONSIN									
EAU CLAIRE									
510840002A01	79	29	9.55	9.55	10.11	3.190	2.669	2.303	2.328
KENOSHA									
511540003A01	79	27	13.82	13.82	15.58	5.709	4.051	4.217	2.383
MADISON									
511860001A01	79*	26	14.84	14.84	17.99	5.629	4.523	4.204	2.188
MILWAUKEE									
512200099A01	79	29	14.46	14.46	14.78	6.602	4.143	5.192	2.149
RACINE									
512880002A01	79	28	14.00	14.00	14.14	6.000	4.038	4.530	2.314
SUPERIOR									
513480006A01	79	27	6.99	6.99	7.44	2.461	2.266	1.590	2.675

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

NONURBAN
NO3

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
INDIANA										
MONROE CO										
152800001A03	79	27	1.08	1.21	1.87	3.37	3.42	4.34	5.62	8.70
MAINE										
ACADIA NAT PAR										
200010001A03	79*	19	.28	.31	.61	.88	.96	1.02	1.29	1.57
MARYLAND										
CALVERT CO										
210280001A03	79	25	1.15	1.67	2.79	3.35	3.50	3.64	4.22	5.06
NEVADA										
WHITE PINE CO										
290560001A03	79	27	.11	.28	.28	.59	.60	.76	.86	1.39
NEW HAMPSHIRE										
COOS CO										
300140001A03	79*	16	.39	.39	.55	.70	.73	.74	1.54	1.89
NEW YORK										
JEFFERSON CO										
333340001A03	79*	19	.77	1.37	2.16	3.02	3.38	3.82	4.49	4.90
VERMONT										
ORANGE CO										
470360001A03	79*	18	.67	.73	.84	1.18	1.96	2.40	2.52	3.42
VIRGINIA										
SHENANDOAH NAT										
482890001A03	79	29	.50	.74	1.27	1.47	1.74	2.14	2.51	2.97
WISCONSIN										
DOOR CO										
510780002A03	79*	17	.28	.30	.43	1.34	1.55	2.47	4.17	4.22

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO CO
UNITS - 81 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<3.0	+4.1	+- 7.0
3.0-6.0	-2.5	+- 3.0
>6.0	+0.4	+- 4.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
INDIANA									
MONROE CO									
152800001A03	79	27	9.90	9.90	12.08	4.018	3.029	3.127	2.054
MAINE									
ACADIA NAT PAR									
200010001A03	79*	19	1.59	2.68	2.68	.958	.571	.820	1.789
MARYLAND									
CALVERT CO									
210280001A03	79	25	5.17	5.31	5.31	3.317	1.157	3.094	1.496
NEVADA									
WHITE PINE CO									
290560001A03	79	27	1.57	1.57	1.61	.633	.446	.498	2.057
NEW HAMPSHIRE									
COOS CO									
300140001A03	79*	16	1.93	2.56	2.56	.969	.659	.807	1.819
NEW YORK									
JEFFERSON CO									
333340001A03	79*	19	7.82	10.93	10.93	3.585	2.396	3.000	1.845
VERMONT									
ORANGE CO									
470360001A03	79*	18	4.67	5.37	5.37	1.899	1.404	1.513	1.967
VIRGINIA									
SHENANDOAH NAT									
482890001A03	79	29	3.57	3.57	6.97	1.926	1.248	1.647	1.751
WISCONSIN									
DOOR CO									
510780002A03	79*	17	6.89	13.80	13.80	2.618	3.417	1.359	3.296

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN
SO4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
ALASKA										
ANCHORAGE										
020040003A01	79*	15	.7	.7	1.1	2.0	3.9	3.9	3.9	3.9
ARIZONA										
DOUGLAS										
030240004A01	79	26	3.9	4.1	5.4	6.2	7.0	7.8	9.2	10.8
PHOENIX										
030600002A01	79*	20	2.1	2.4	3.9	4.1	4.2	4.8	5.4	7.0
TUCSON										
030860001A01	79	26	1.6	3.9	3.9	4.4	5.3	5.4	6.4	7.2
CALIFORNIA										
ANAHEIM										
050230001A01	79*	20	2.9	3.7	6.0	7.7	9.2	9.7	11.2	17.5
BERKELEY										
050740001A01	79*	20	1.5	3.0	3.9	4.4	4.4	4.7	4.9	5.3
FRESNO										
052800002A01	79*	20	1.2	1.7	2.5	2.7	3.9	3.9	4.0	4.8
LOS ANGELES										
054180001A01	79*	19	3.3	4.0	5.8	6.2	6.3	9.2	10.1	15.4
ONTARIO										
055380001A01	79*	21	2.6	4.4	6.5	8.8	9.9	12.1	14.7	16.1
SACRAMENTO										
056580001A01	79*	21	1.1	1.3	2.4	3.7	4.2	4.9	5.2	5.7
SAN BERNARDINO										
056680001A01	79*	20	2.5	3.6	5.4	8.4	8.9	10.7	11.6	16.8
SAN DIEGO										
056800004A01	79*	20	4.3	4.4	5.2	6.5	6.6	8.3	9.4	11.5
SAN JOSE										
056980004A01	79*	20	1.6	1.6	2.0	3.6	3.9	3.9	4.4	6.1
SANTA ANA										
057180001A01	79*	20	2.8	4.6	5.6	8.5	8.8	9.9	11.0	14.4
CONNECTICUT										
BRIDGEPORT										
070060001A01	79	27	4.1	5.7	7.5	10.7	11.9	13.2	15.0	17.6
NEW HAVEN										
070700123A01	79	27	4.6	5.6	7.8	11.1	12.1	13.0	14.7	17.4
WATERBURY										
071240123A01	79	27	3.0	4.7	6.2	7.7	8.4	10.2	13.8	16.0

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ALASKA									
ANCHORAGE									
020040003A01	79*	15	3.9	3.9	3.9	2.45	1.44	2.00	2.001
ARIZONA									
DOUGLAS									
030240004A01	79	26	15.1	15.1	19.0	7.44	3.66	6.78	1.523
PHOENIX									
030600002A01	79*	20	7.5	8.2	8.2	4.66	1.54	4.43	1.392
TUCSON									
030860001A01	79	26	8.8	8.8	9.4	5.13	1.87	4.80	1.473
CALIFORNIA									
ANAHEIM									
050230001A01	79*	20	19.4	19.4	19.4	9.10	4.81	8.03	1.677
BERKELEY									
050740001A01	79*	20	5.4	6.6	6.6	4.25	1.05	4.10	1.352
FRESNO									
052800002A01	79*	20	6.2	6.3	6.3	3.32	1.40	3.05	1.539
LOS ANGELES									
054180001A01	79*	19	16.2	19.9	19.9	8.47	4.59	7.52	1.628
ONTARIO									
055380001A01	79*	21	17.2	18.3	18.3	9.77	4.55	8.73	1.660
SACRAMENTO									
056580001A01	79*	21	6.0	6.2	6.2	3.67	1.62	3.26	1.696
SAN BERNARDINO									
056680001A01	79*	20	19.4	24.1	24.1	9.54	5.59	8.15	1.792
SAN DIEGO									
056800004A01	79*	20	12.2	14.0	14.0	7.38	2.84	6.92	1.432
SAN JOSE									
056980004A01	79*	20	6.9	7.3	7.3	3.64	1.67	3.29	1.596
SANTA ANA									
057180001A01	79*	20	15.2	21.3	21.3	9.04	4.41	8.11	1.623
CONNECTICUT									
BRIDGEPORT									
070060001A01	79	27	19.4	19.4	20.4	11.00	4.67	10.03	1.568
NEW HAVEN									
070700123A01	79	27	19.2	19.2	19.5	11.24	4.27	10.45	1.490
WATERBURY									
071240123A01	79	27	18.5	18.5	25.9	9.66	5.28	8.53	1.648

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN
SO4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
FLORIDA										
DAVIE										
100910002A01	79	29	2.4	3.8	5.3	6.2	6.4	6.8	7.2	9.9
JACKSONVILLE										
101960049A01	79	26	2.9	4.3	6.7	8.4	9.7	10.4	12.2	12.4
TAMPA										
104360002A01	79*	22	5.1	5.5	9.2	9.8	10.5	11.4	14.8	15.2
HAWAII										
HONOLULU										
120120001A01	79	29	3.4	4.4	5.7	6.1	6.6	6.8	7.3	7.6
INDIANA										
EVANSVILLE										
151300006A01	79*	21	7.2	7.4	8.9	10.7	13.7	15.0	18.5	24.1
GARY										
151520001A01	79*	21	5.9	6.4	9.4	12.8	13.3	13.4	14.7	15.9
HAMMOND										
151780001A01	79*	23	5.0	5.4	10.4	13.6	16.7	18.6	20.0	28.8
INDIANAPOLIS										
152040002A01	79*	18	4.7	5.8	8.6	11.1	14.7	17.6	18.7	19.3
SOUTH BEND										
153880002A01	79*	21	3.9	4.0	6.6	9.1	10.5	13.3	17.1	21.8
TERRE HAUTE										
154080001A01	79*	20	6.1	6.4	9.7	11.0	12.4	15.1	19.4	20.9
IOWA										
DAVENPORT										
161060001A01	79*	22	5.0	5.6	7.1	9.2	9.6	10.6	14.2	22.6
DES MOINES										
161180001A01	79*	23	2.6	3.3	5.1	6.0	7.2	7.9	8.1	10.2
KENTUCKY										
COVINGTON										
180800001A01	79	30	6.6	8.3	10.3	12.3	13.8	15.9	20.4	23.2
LEXINGTON										
182300003A01	79	29	7.3	7.9	10.1	12.1	12.3	14.5	17.7	20.2
LOUISVILLE										
182380035A01	79*	16	8.3	9.0	9.8	11.4	13.8	16.5	22.9	28.3
MAINE										
PORTLAND										
200960004A01	79	23	4.9	5.1	6.9	9.8	11.6	13.3	14.2	15.2

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
FLORIDA									
DAVIE									
100910002A01	79	29	11.5	11.5	11.6	6.34	2.27	5.96	1.443
JACKSONVILLE									
101960049A01	79	26	16.5	16.5	18.2	9.06	3.70	8.31	1.549
TAMPA									
104360002A01	79*	22	15.2	15.6	15.6	10.68	3.13	10.22	1.364
HAWAII									
HONOLULU									
120120001A01	79	29	10.6	10.6	11.2	6.45	1.68	6.25	1.286
INDIANA									
EVANSVILLE									
151300006A01	79*	21	25.9	36.3	36.3	14.08	7.42	12.66	1.572
GARY									
151520001A01	79*	21	24.6	40.6	40.6	13.27	7.55	11.90	1.569
HAMMOND									
151780001A01	79*	23	30.6	52.2	52.2	16.74	10.39	14.36	1.754
INDIANAPOLIS									
152040002A01	79*	18	23.0	23.9	23.9	13.29	5.97	11.97	1.625
SOUTH BEND									
153880002A01	79*	21	22.8	23.6	23.6	11.29	6.15	9.83	1.722
TERRE HAUTE									
154080001A01	79*	20	24.2	87.7	87.7	16.62	17.58	13.08	1.838
IOWA									
DAVENPORT									
161060001A01	79*	22	26.8	43.4	43.4	12.28	8.96	10.37	1.730
DES MOINES									
161180001A01	79*	23	22.0	24.3	24.3	7.57	5.37	6.42	1.736
KENTUCKY									
COVINGTON									
180800001A01	79	30	26.3	26.3	31.9	14.71	6.34	13.56	1.497
LEXINGTON									
182300003A01	79	29	25.7	25.7	37.8	13.82	6.61	12.67	1.498
LOUISVILLE									
182380035A01	79*	16	30.2	38.4	38.4	16.36	9.16	14.45	1.638
MAINE									
PORTLAND									
200960004A01	79	23	18.2	29.1	29.1	10.79	5.62	9.63	1.614

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

U R B A N
S O 4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
MARYLAND										
BALTIMORE										
210120001A01	79	26	4.9	6.4	8.7	10.4	14.7	15.2	16.2	16.8
MASSACHUSETTS										
BOSTON										
220240012A01	79*	20	5.4	6.5	7.3	9.8	10.4	12.0	15.4	17.8
CAMBRIDGE										
220360001A01	79*	21	4.7	5.4	8.1	9.8	10.3	11.1	12.7	14.9
FALL RIVER										
220580001A01	79*	15	5.1	6.9	7.7	11.6	12.3	13.3	14.6	16.8
NEW BEDFORD										
221500002A01	79	27	4.5	6.8	9.8	10.8	11.2	11.9	12.5	15.0
SPRINGFIELD										
222160002A01	79*	23	5.3	5.8	8.7	11.2	11.8	12.8	14.6	18.8
WORCHESTER										
222640004A01	79	27	5.7	6.4	8.4	9.5	10.5	11.3	13.1	15.9
MINNESOTA										
DULUTH										
241040017A01	79*	21	3.9	3.9	3.9	5.0	5.5	6.2	7.7	8.0
NEBRASKA										
OMAHA										
281880034A01	79	29	3.9	3.9	4.1	7.4	7.8	9.3	10.6	14.4
NEVADA										
LAS VEGAS										
290320001A01	79*	25	.7	1.3	3.7	3.9	3.9	3.9	3.9	4.7
RENO										
290480001A01	79	30	.7	.9	1.4	2.2	2.3	2.8	3.9	3.9
NEW HAMPSHIRE										
CONCORD										
300120002A01	79*	15	3.8	4.9	6.6	8.3	8.4	10.1	13.8	16.5
NEW JERSEY										
ELIZABETH										
311300002A01	79*	22	6.0	6.2	8.0	12.2	13.2	13.9	14.9	15.5
GLASSBORO										
311700001A01	79*	22	7.8	8.3	9.8	11.1	11.4	11.8	13.8	15.8
JERSEY CITY										
312320001A01	79*	16	6.9	7.6	10.4	13.4	14.9	16.4	22.9	23.6

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
MARYLAND									
BALTIMORE									
210120001A01	79	26	23.1	23.1	23.8	12.19	5.15	11.17	1.540
MASSACHUSETTS									
BOSTON									
220240012A01	79*	20	18.3	26.6	26.6	11.37	5.36	10.39	1.528
CAMBRIDGE									
220360001A01	79*	21	16.6	17.6	17.6	10.15	3.58	9.55	1.435
FALL RIVER									
220580001A01	79*	15	16.8	18.1	18.1	11.22	3.98	10.53	1.460
NEW BEDFORD									
221500002A01	79	27	17.9	17.9	20.3	11.18	3.43	10.66	1.379
SPRINGFIELD									
222160002A01	79*	23	19.2	29.9	29.9	11.90	5.50	10.92	1.513
WORCHESTER									
222640004A01	79	27	17.1	17.1	34.8	11.05	5.72	10.13	1.488
MINNESOTA									
DULUTH									
241040017A01	79*	21	11.6	18.1	18.1	6.18	3.33	5.63	1.493
NEBRASKA									
OMAHA									
281880034A01	79	29	17.8	17.8	18.2	7.95	4.25	6.99	1.666
NEVADA									
LAS VEGAS									
290320001A01	79*	25	4.9	11.8	11.8	3.72	2.00	3.29	1.703
RENO									
290480001A01	79	30	4.9	4.9	7.3	2.45	1.52	2.05	1.842
NEW HAMPSHIRE									
CONCORD									
300120002A01	79*	15	16.5	16.8	16.8	9.33	4.15	8.51	1.565
NEW JERSEY									
ELIZABETH									
311300002A01	79*	22	18.3	25.2	25.2	12.12	4.64	11.30	1.471
GLASSBORO									
311700001A01	79*	22	17.1	17.6	17.6	11.57	2.78	11.27	1.260
JERSEY CITY									
312320001A01	79*	16	25.4	25.9	25.9	15.24	6.61	13.94	1.552

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN
SO4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
NEW JERSEY										
NEWARK										
313480001A01	79	26	5.6	7.0	9.5	12.4	14.7	16.1	19.6	21.9
TRENTON										
315400001A01	79*	18	7.4	8.6	10.2	11.6	12.3	17.3	18.0	20.4
NEW YORK										
ALBANY										
330040001A01	79*	16	5.8	5.9	9.3	11.0	11.7	12.4	18.9	20.3
BUFFALO										
330660001A01	79*	19	6.1	6.8	9.5	11.7	11.7	12.4	13.7	15.7
NIAGARA FALLS										
334740001A01	79	30	5.8	7.5	9.1	10.2	11.1	12.9	15.9	16.9
ROCHESTER										
335760001A01	79*	19	6.6	6.6	9.5	11.0	11.0	13.3	15.1	16.9
SYRACUSE										
336620001A01	79*	27	5.5	5.8	7.0	8.8	9.1	10.7	12.6	14.9
UTICA										
336880001A01	79	28	4.3	5.4	6.6	8.4	9.4	10.1	12.8	14.7
YONKERS										
337620001A01	79*	21	4.1	4.1	8.6	11.1	13.4	13.5	15.6	17.4
NORTH CAROLINA										
CHARLOTTE										
340700001A01	79	29	4.2	5.0	6.7	8.6	8.8	9.2	10.8	14.2
DURHAM										
341160001A01	79	28	5.1	5.8	6.8	9.2	9.7	10.1	10.8	13.7
MOREHEAD CITY										
342720002A01	79*	26	1.4	3.3	4.8	7.1	7.8	8.8	9.4	9.6
WINSTON-SALEM										
344460002A01	79	25	5.2	5.9	8.4	9.6	10.7	13.4	14.5	20.2
OHIO										
AKRON										
360060014A01	79	25	5.1	8.1	11.1	14.0	15.7	16.9	18.6	21.0
CANTON										
361000001A01	79	27	5.9	8.2	11.0	14.1	15.3	16.4	18.5	20.5
CINCINNATI										
361220001A01	79	27	4.7	7.3	10.2	12.9	14.1	15.5	19.6	28.1
361220019A01	79*	17	5.4	7.0	8.3	12.2	12.3	16.1	20.5	21.9
CLEVELAND										
361300001A01	79*	25	5.0	8.3	9.4	11.9	13.3	13.9	17.0	19.8

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
NEW JERSEY									
NEWARK									
313480001A01	79	26	25.9	25.9	26.9	13.90	6.03	12.68	1.559
TRENTON									
315400001A01	79*	18	22.0	25.1	25.1	14.00	5.18	13.17	1.427
NEW YORK									
ALBANY									
330040001A01	79*	16	21.1	27.2	27.2	12.86	5.97	11.73	1.550
BUFFALO									
330660001A01	79*	19	19.1	23.7	23.7	11.80	4.37	11.13	1.413
NIAGARA FALLS									
334740001A01	79	30	18.4	18.4	20.4	11.65	3.85	11.07	1.382
ROCHESTER									
335760001A01	79*	19	21.0	24.4	24.4	12.25	4.76	11.49	1.435
SYRACUSE									
336620001A01	79*	27	17.0	17.0	23.0	9.83	4.16	9.14	1.456
UTICA									
336880001A01	79	28	15.8	15.8	19.4	9.49	3.83	8.81	1.477
YONKERS									
337620001A01	79*	21	18.2	26.1	26.1	11.81	5.20	10.71	1.603
NORTH CAROLINA									
CHARLOTTE									
340700001A01	79	29	17.6	17.6	24.9	9.26	4.47	8.44	1.527
DURHAM									
341160001A01	79	28	18.5	18.5	22.5	9.73	3.93	9.11	1.435
MOREHEAD CITY									
342720002A01	79*	26	10.9	10.9	22.6	7.37	3.98	6.49	1.707
WINSTON-SALEM									
344460002A01	79	25	29.9	39.8	39.8	12.43	7.95	10.80	1.662
OHIO									
AKRON									
360060014A01	79	25	21.9	25.7	25.7	14.28	5.23	13.30	1.491
CANTON									
361000001A01	79	27	21.8	21.8	24.5	14.45	4.73	13.66	1.423
CINCINNATI									
361220001A01	79	27	35.3	35.3	45.9	16.02	9.66	13.87	1.702
361220019A01	79*	17	30.7	41.4	41.4	15.02	9.39	12.94	1.722
CLEVELAND									
361300001A01	79*	25	20.6	23.4	23.4	12.71	4.60	11.92	1.449

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN
SO4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
OHIO										
COLUMBUS										
361460001A01	79*	24	7.0	7.4	8.4	10.4	11.4	13.8	16.1	19.7
MANSFIELD										
363840008A01	79	29	6.3	6.7	9.0	11.9	12.4	12.9	14.8	18.8
PORTSMOUTH										
365620002A01	79	28	.7	7.2	10.3	12.4	12.9	14.4	15.5	17.5
STEUBENVILLE										
366420012A01	79	28	5.3	7.0	10.6	15.8	20.9	22.7	29.4	35.8
TOLEDO										
366600006A01	79	29	7.4	8.8	11.7	13.3	14.2	17.6	20.3	20.8
YOUNGSTOWN										
367760001A01	79	26	5.3	6.5	11.9	14.0	16.0	17.8	18.5	19.5
PUERTO RICO										
GUAYANILLA CO										
401100003A01	79*	22	6.3	7.1	8.7	9.2	10.6	11.1	11.9	12.4
GUAYNABO CO										
401140001A01	79*	18	8.0	8.4	10.6	12.4	12.8	13.1	13.7	14.4
PONCE										
401920002A01	79	22	3.6	4.3	4.7	5.5	6.3	7.6	7.8	8.8
SAN JUAN CO										
402160003A01	79	26	5.3	6.3	7.2	8.0	8.4	8.6	8.8	9.2
TOA BAJA CO										
402320002A01	79	27	3.8	4.5	6.9	8.9	10.1	11.1	11.7	12.0
RHODE ISLAND										
EAST PROVIDENC										
410120008A01	79*	23	6.0	6.0	8.6	10.4	11.1	11.2	13.2	15.8
SOUTH CAROLINA										
GREENVILLE										
421180001A01	79*	21	3.9	5.3	7.6	8.8	8.9	10.6	11.2	14.4
TENNESSEE										
CHATTANOOGA										
440380020A01	79	30	4.0	4.3	7.1	9.7	10.2	12.9	15.2	17.7
MEMPHIS										
442340013A01	79*	17	3.9	4.5	6.2	11.0	11.4	14.5	18.3	20.9
VIRGINIA										
NORFOLK										
482140001A01	79	29	8.0	9.7	10.4	11.6	12.8	13.6	14.0	19.8

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
OHIO									
COLUMBUS									
361460001A01	79*	24	22.2	30.9	30.9	12.59	5.90	11.55	1.501
MANSFIELD									
363840008A01	79	29	22.5	22.5	23.0	12.17	4.58	11.40	1.442
PORTSMOUTH									
365620002A01	79	28	32.6	32.6	34.6	13.62	7.03	11.74	1.933
STEUBENVILLE									
366420012A01	79	28	42.4	42.4	55.0	19.80	12.53	16.37	1.890
TOLEDO									
366600006A01	79	29	23.0	23.0	23.7	14.84	4.73	14.11	1.383
YOUNGSTOWN									
367760001A01	79	26	21.0	21.0	37.2	14.82	6.41	13.59	1.544
PUERTO RICO									
GUAYANILLA CO									
401100003A01	79*	22	12.5	13.3	13.3	9.95	1.93	9.76	1.222
GUAYNABO CO									
401140001A01	79*	18	15.0	17.3	17.3	12.25	2.36	12.03	1.222
PONCE									
401920002A01	79	22	9.0	10.8	10.8	6.29	1.94	6.03	1.350
SAN JUAN CO									
402160003A01	79	26	11.6	11.6	16.3	8.27	2.18	8.05	1.258
TOA BAJA CO									
402320002A01	79	27	14.7	14.7	20.4	9.29	3.56	8.65	1.484
RHODE ISLAND									
EAST PROVIDENC									
410120008A01	79*	23	16.7	18.6	18.6	10.63	3.54	10.08	1.394
SOUTH CAROLINA									
GREENVILLE									
421180001A01	79*	21	15.7	17.4	17.4	9.37	3.40	8.81	1.435
TENNESSEE									
CHATTANOOGA									
440380020A01	79	30	24.2	24.2	37.3	11.44	6.97	9.92	1.695
MEMPHIS									
442340013A01	79*	17	21.7	31.9	31.9	12.24	7.70	10.24	1.851
VIRGINIA									
NORFOLK									
482140001A01	79	29	23.7	23.7	25.9	13.18	4.38	12.61	1.338

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN
SO4

SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
WASHINGTON										
SPOKANE										
492040001A01	79*	25	1.6	2.2	3.5	4.5	4.8	5.3	5.7	7.3
WISCONSIN										
EAU CLAIRE										
510840002A01	79	29	3.3	3.9	4.1	5.3	6.5	8.5	9.2	11.8
KENOSHA										
511540003A01	79	27	2.5	5.4	6.3	7.8	9.5	10.4	12.5	14.2
MADISON										
511860001A01	79*	26	3.3	3.9	5.7	6.7	7.4	8.6	10.9	12.1
MILWAUKEE										
512200099A01	79	29	4.0	5.8	8.0	9.7	10.2	10.9	12.7	14.8
RACINE										
512880002A01	79	28	4.4	5.3	6.6	8.1	9.3	10.4	11.2	15.0
SUPERIOR										
513480006A01	79	24	3.9	3.9	5.2	6.7	7.4	8.3	11.8	15.2

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
WASHINGTON									
SPOKANE									
492040001A01	79*	25	7.4	8.5	8.5	4.52	1.83	4.14	1.559
WISCONSIN									
EAU CLAIRE									
510840002A01	79	29	16.4	16.4	34.7	7.60	6.12	6.37	1.719
KENOSHA									
511540003A01	79	27	15.7	15.7	29.7	9.53	5.21	8.51	1.606
MADISON									
511860001A01	79*	26	15.8	15.8	19.4	7.95	4.01	7.14	1.595
MILWAUKEE									
512200099A01	79	29	19.2	19.2	29.2	10.49	5.02	9.61	1.510
RACINE									
512880002A01	79	28	17.2	17.2	29.8	9.62	5.21	8.69	1.546
SUPERIOR									
513480006A01	79	24	15.3	15.6	15.6	8.00	3.76	7.27	1.556

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

NONURBAN

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SITE:	YR	NO.	MIN	10	30	50	60	70	80	90
INDIANA										
MONROE CO										
152800001A03	79	27	5.2	7.2	9.3	11.8	13.1	17.4	23.0	25.9
MAINE										
ACADIA NAT PAR										
200010001A03	79*	19	3.0	3.4	4.1	6.1	6.1	6.3	7.6	9.2
MARYLAND										
CALVERT CO										
210280001A03	79	25	5.6	6.6	7.4	7.9	8.2	9.6	10.4	11.9
NEVADA										
WHITE PINE CO										
290560001A03	79	27	.7	.7	1.5	3.9	3.9	3.9	3.9	3.9
NEW HAMPSHIRE										
COOS CO										
300140001A03	79*	16	.8	1.6	4.1	5.3	6.9	6.9	9.9	10.4
NEW YORK										
JEFFERSON CO										
333340001A03	79*	19	3.8	4.4	6.0	7.2	7.4	8.2	9.3	11.3
VERMONT										
ORANGE CO										
470360001A03	79*	18	3.9	3.9	3.9	5.6	5.9	8.1	8.4	9.7
VIRGINIA										
SHENANDOAH NAT										
482890001A03	79	29	3.8	5.3	7.5	8.4	8.8	9.1	13.5	18.2
WISCONSIN										
DOOR CO										
510780002A03	79*	17	1.6	2.6	3.7	5.3	5.7	7.9	8.9	9.6

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-6.7	+- 6.0
6.0-20.0	-2.0	+- 4.0
>20.0	-2.9	+- 1.0

SITE:	YR	NO.	95	98	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
INDIANA									
MONROE CO									
152800001A03	79	27	33.3	33.3	39.1	15.32	8.98	13.19	1.733
MAINE									
ACADIA NAT PAR									
200010001A03	79*	19	10.0	10.1	10.1	5.98	2.16	5.62	1.437
MARYLAND									
CALVERT CO									
210280001A03	79	25	12.2	15.4	15.4	8.67	2.28	8.42	1.276
NEVADA									
WHITE PINE CO									
290560001A03	79	27	3.9	3.9	3.9	2.67	1.34	2.26	1.898
NEW HAMPSHIRE									
COOS CO									
300140001A03	79*	16	13.1	20.1	20.1	6.98	4.78	5.48	2.199
NEW YORK									
JEFFERSON CO									
333340001A03	79*	19	15.6	18.9	18.9	8.10	3.80	7.44	1.506
VERMONT									
ORANGE CO									
470360001A03	79*	18	11.0	14.1	14.1	6.53	2.93	6.01	1.508
VIRGINIA									
SHENANDOAH NAT									
482890001A03	79	29	21.0	21.0	21.6	10.09	4.98	9.09	1.575
WISCONSIN									
DOOR CO									
510780002A03	79*	17	10.4	15.6	15.6	6.15	3.60	5.25	1.800

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